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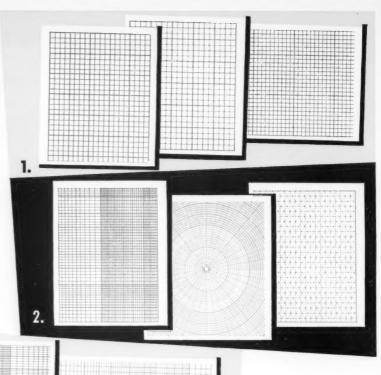
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Design Engineering

Vol. 5

MAY 1959

No. 5



This month's cover

Artist Frank Davies is responsible for putting everyone to work. If you're Philadelphia-bound, we suggest you snub that quartet of cam-shifters: and you won't catch us loitering near the scale-plate jockey either. Reason: those thinly dilineated cover men have a too-thinly disguised vagrancy cathexis for our liking. Note jet trail in morse code, a fond farewell.

Design Engineering

MEMBER

CCAB

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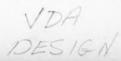
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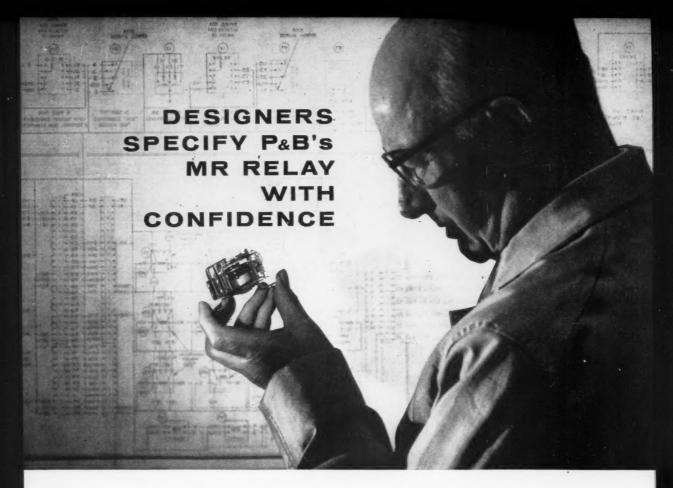
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CONTENTS

Features

Casting redesign: a study in strain patterns	45
Pressure gauges using a Bourdon tube	48
Design Engineering Show	51
Scale plates	55
Cam design: modern applications	58
The hypsometer for long term stability	62
Numerical control without memory store	66
Short features	
NIDC Awards for '59	60
Data Sheet: section properties	61
Departments	
Briefs 74,	75
Design news in pictures	65
Editorial	86
Ideas round-up 69, 70, 71,	72
Keeping informed	73
New products	82
People in the news	80
Reader service card 87,	88
Reports 5	, 6





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For more information about this medium duty, compact relay, call or write today—or get in touch with the P&B sales engineer nearest you. See our complete catalog in Sweet's Product Design File.



LM SERIES: Plate circuit relays similar to the MR. All sp and be contact arrangements shown above are available. Coils are wound to specified resistances up to 58,000 ohms max. Sensitivity ranges from 15 mw min. (signor pole) to 70 mw min. (double pole).

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A native of Lethbridge, Alta. A. Opstad graduated from the University of Alberta in 1956 with a B.Sc., in electrical engineering. He has since been working on the testing of newly designed equipment with CGE — before being appointed instrument design engineer at this company's Quebec plant. A first-time contributor to DE, Opstad wrote the article on scale plates; keeps fit with curling and hockey.

Louis H. Ravitch wrote the article on casting redesign. A Benton Harbor, Mich., man he studied at the state uni-





Opstad Ravitch

versity—and three years ago attended a special course in strain gauge fundamentals at MIT. His work history includes 12 years with GM in various technical divisions. He is now a stress analyst in the experimental and development department in this company's central Foundry division.

Article on cams was written by L. S. Eggleton, a several times contributor to DE. We contacted him for a new photograph and the latest information about himself. He sent us a new photo but told us the biographical department was slack. So we flipped back to DE's Oct '58 issue for the facts. Eggleton is a technical writer for Aviation Electric in Montreal; a member of the Society of Technical Writers and Editors the Canadian Industrial Editors Association. He has traveled widely in many parts of the world, Malaya and South America.

Designer is clef-switcher, too. The article on pressure gauges was written

by James D. Orr, partner in the Toronto firm of Orr Associates — consulting product planners, designers and engineers. He is a graduate in mechanical engineering of U. of Toronto and he attended MIT. He also writes and lectures about his job. Playing trumpet in a symphony orchestra for a hobby — we now hear that he's muscled into the string section and is studying the 'cello.





On

Gilbert Hobrough's latest professional work is the Stereomat—an electronic device which achieves automatic correlation of stereo images, and automatically draws profiles and contours. Photo shows both man and machine. Unsurprisingly enough, Hobrough (of Hunting Associates Ltd.) is an addict of hi-fi and stereo photography. We also understand that the bachelor author of the hypsometer article shows rare acumen in the selection of inspired viands.





F

Our contributor on automatic machine tool control — H. G. Hauck — came to Canada the hard way. He spent the early years of his life in Nassau in the Bahamas, was educated in England, then came here in 1954 when he joined Westinghouse. He is now responsible for marketing Sperry's numerical control equipment.



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• The Chicago Rawhide Manufacturing Company of Canada Limited designed their "Block Vee" Oil Seal to be as efficient as an entire stack of ordinary multiple vees. Assembled in the groove of a hydraulic or pneumatic cylinder, the Block Vee permits larger tolerances but will not roll or twist like an O-ring. But to attain the efficient shape of the vee while retaining the sensitive free movement, a special rubber was needed.

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Reports

A news roundup of items of engineering and design interest from the world over

The upward pressure and the quarter turn



Servicing light fixtures recessed in ceilings is often a series of elbow-wrenching gymnastics. A company wrote and told us that they had licked the problem with a method centering around a spring-operated catch that replaces the conventional-type screw. Upward pressure and a quarter turn on each of the two catches, releases the frame in a jiffy. The device is now standard on all the firm's downlights and is designed as an integral part of the cast aluminum frame. The catch itself is assembled with a tempered stainless steel spring. Photo shows the lip attached to the shank which former clamps over a flange at the lower edge of light housing. It's so simple, we kicked ourselves for not thinking about it first.

A screwdriver (and \$850) puts it in your driveway



It had to be. The "do-it-yourself" family car has finally rolled off the assembly line in packing cases. Described as a miniature, super-economy car, the Nobel 200, squeezes close to 100 miles out of every Imperial gallon and boasts a fiberglass body. It seats two adults and two children and the Sachs 10.2 bhp engine and a four-speed synchromesh gearbox provides a top speed of 65 mph. Small by North American standards (10½ ft long), the Nobel is said to be very easy to handle and park. The car is jointly produced by the Bristol Aircraft Co. and Short and Harland Ltd.—both U. K. aircraft manufacturers. The assembled export model will sell for under \$1,000 and the "screw-it-to-gether-in-80-hours" version for about \$150 less.

Contact lenses get soaking routine



Not only is the next item of design interest—it also fits in the "purely personal" category. Wearers of contact lenses find them more comfortable if the lenses are kept in a soaking solution when not in use. A manufacturer recognized this need and came up with a sensible answer in the form of a soaking kit. Exploded view shows one of the containers, which fits into a small carrying case. Individual containers for the right and left lens allow the lenses to float freely and be completely hydrated. Tight-fitting tops, with molded markings for easy touch identification, prevent solution from leaking out into pocket or purse. Unit fits in container and is made entirely of soft-surfaced Eastman tenite polyethylene.

Jack Frost kept at bay with small padlock



This is really a bad weather story — but it sounds good enough to remember when you're knee deep in snow next winter. Item at left is a padlock designed to permit quick entrance to outdoor enclosures regardless of icing conditions. The yoke and lock shaft are brass, and the lock body is cast from red brass. A strong alnico V permanent magnet keeps the lock cover shut. When slight hand pressure is applied to the yoke, lurking ice cracks and falls away. Because water cannot enter the key chamber, the tumblers will not freeze. All working parts we note, are protected by silicone grease and visible parts are cadmium-plated. We are glad to report that this lock is another all-Canadian product. Mr. J. L. Kielland is the designer and Canadian Line Materials Ltd. manufacture and sell it.

Tote your own bags at the end of this safari



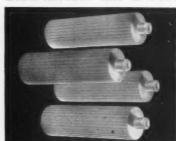
This item might catch you off guard while you are slaving away at your desk or drawing board—and revive your appetite for adventure. The man is Lionel Forge and he's riding in what he believes in Canada's only sea-going station wagon. Basically, vehicle is an army surplus duck (bought legless for \$300), to which a station-wagon top has been grafted. Forge is a dedicated adventurer. He is a parachutist, an internationally-known figure skater and an expert skin diver. This summer he's heading for South America to make movies of underwater life and photograph archeological sites. We'd better inform you that all the bunks are booked—just in case your spirit of adventure is stronger than we think.

Filling in this sandwich-belting carries load



Suspender-narrow leather belting with a plastic core is apparently getting a close look from industry. Mr. G. P. Branch, Ontario manager of Extremultus Transmissions told DE in a recent interview that a big feature of the belting is that it virtually eliminates stretch. It will also run for years on fixed centres without adjustment. Belting consists of a polymer tensile member, sandwiched between a chrome-tanned leather friction surface. "However, unlike other belts," Mr. Branch went on, "the leather serves only as a friction surface. The load-carrying is left to the plastic centre." We asked him about applications and he said that some belts run at 24,000 fpm; others at 20:1 ratios. They can be used for low bearing loads, on cone pulleys, and where load shocks are severe. As we said, this could be a trend.

Blow-molder has a continuously running extruder



World markets being what they are, the matter of peak production is of supreme importance. We are therefore not reluctant to tell you about an automatic blow-molding machine that is said to have an exceptionally high output of hollow items up to 6 in. diameter and 32 in. long. Machine permits molding up to 140 lb. of material per hour from a continuously running extruder. Molding takes place in two positions with two molds located at each position. With four extruder heads (one above each mold), parison extrusion at one position takes place simultaneously with blow-molding and cooling in the other two molds. The molded material is thus constantly being cooled, except for the split second required for mold closure prior to blow-molding. Machine is made by Auto-Blow Corporation and photo shows 12 oz. screw cap bottles.

Brackish water played havoc with the rudders

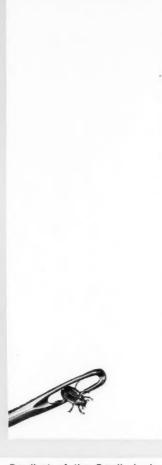


Our illustration shows a new type of stainless steel strut and rudder combination. The strut is made in a casting of 60 lb—and the rudder in a casting of 110 lb. This combination is now being used on special transportation boats for the oil industry in South America. The 52 ft craft are called on to turn and twist quickly in the brackish waters of the inlet and along the coastal channels. Because of the unusually corrosive condition of these waters, New York marine architect Philip Rhoades when called in to redesign the combination, chose Type 316 stainless steel. Unit is now expected to outlast the boat itself (previous units made of a softer metal had to be replaced often). The Buffalo, N.Y., plant of Allegheny Ludlum Steel Co. made the units.

Suite of banking-aids cuts paper work



We are told that one of the biggest bottlenecks in banking is sorting the millions of cheques, deposit slips and other papers that are passed over bank counters every year. A suite of banking aids has been developed to alleviate this problem and the machine at left is claimed to be the world's fastest document sorter. An electronic device, it reads characters printed with magnetic ink on bank cheques and other documents, and sorts them at the rate of 1,500 per minute. Working concurrently with this gadget, is a magnetic imprinter and a magnetic account and amount number printer. Both are used to print number and symbols in magnetic ink on cheques—provide the "trigger" for automatic devices in the bank's system. Burroughs Corp. created the jinn.







Smallest of the Small. A pigmy beetle could easily crawl through the eye of an ordinary sewing needle, as shown by this equally magnified view of both. Among the tiniest of insects, some species of pigmy beetles reach about onehundredth of an inch in length.

Miniature for Missiles. This tape recorder, shown one-sixth actual size, is a vital unit in the communications system of the Army's "talking satellite." Constant low-torque and quiet operation of MPB bearings in it maintain accurate tape position.

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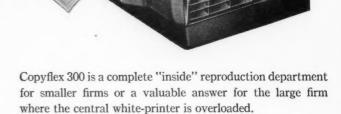
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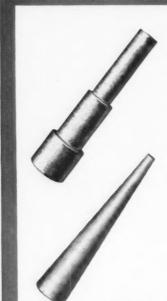
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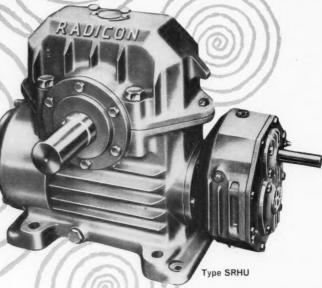
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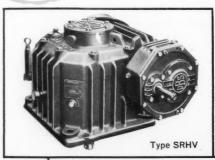
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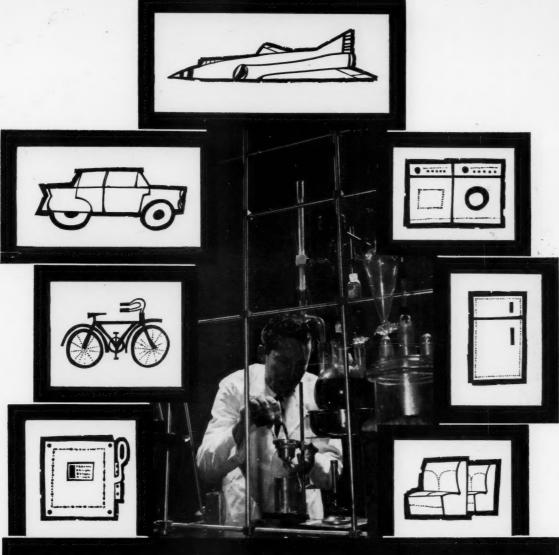
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Check the tolerance chart below

Lasting corrosion protection for valve stems in storage. Ordinary corrosion inhibitors fail to protect after the sacrificial metal is consumed. J-M No. 9 operates on an entirely different principle. Photograph shows how, under accelerated tests, the sacrificial inhibitor (at left) failed after a few weeks but the valve stem protected by J-M No. 9 (at right) was clean months later. Specify J-M No. 9 inhibitor when you order J-M die-formed packing rings.

Representative will be glad to give you lists and descriptions of the styles in each range and those with which the J-M No. 9 Corrosion Inhibitor (see right above) may be specified or is standard. Write to Dept. IA, Canadian Johns-Manville Co. Ltd., Port Credit, Ontario.

JOHNS-MANVILLE DIE-FORMED PACKING RING TOLERANCES	DENSE RINGS (including plastics)		SOFT RINGS (including cloth rings)			METALLIC RINGS			
	I.D.	O.D.	Depth	I.D.	O.D.	Depth	I.D.	O.D.	Depth
to and incl. ½" O.D.	+.008" 000"	+.000" 008"	±1/64"	+.008" 000"	+.000" 015"	±1/64"	+.008" 000"	+.000" -1/32"	±1/32"
Over ½" to and incl. 1" O.D.	+.008" 000"	+.000" 008"	±1/32"	+.008" 000"	+.000" 015"	±1/32°	+.008" 000"	+.000" -1/32"	±1/32"
Over 1" to and incl. 2%" O.D.	+.008" 000"	+.000" -1/64"	±1/32"	+.010" 000"	+.000" -1/32"	±1/32"	+.008" 000"	+.000" -1/32"	±1/32"
Over 2 %" O.D.	+.010" 000"	+.000" -1/32"	±1/32"	+.010" 000"	+.000" -3/64"	±1/32"	+.008"	+.000" -1/32"	±1/32"

Bevel (on all styles) $\pm 5^{\circ}$ when required



Johns-Manville PACKINGS, GASKETS and TEXTILES

1-3044

NOW IN CANADA

IMPLEX A

...for <u>outstanding toughness</u>—a modified acrylic molding powder in the medium price range

CHECK THIS COMBINATION OF DESIRABLE PROPERTIES:

- High impact strength
- Good structural strength
- Low water absorption
- No plasticizer
- Excellent resistance to staining (grease, lipstick, soft drinks, tea, coffee, etc.)
- No unpleasant odor
- Specific gravity-1.12
- Wide range of colors (natural color—off-white translucent)
- Excellent machinability and nailability
- Easily molded
- High heat resistance

Now . . . from Rohm & Haas, pioneer in acrylic plastics . . . IMPLEX A, a modified acrylic molding powder with toughness and stability at an economical price.

IMPLEX A is durable . . . resists breakage, aging, discoloration and staining. It is now being manufactured in commercial quantities, with increased production due in several months. Write for technical data, prices and samples. Please mention the specific applications in which you are interested.



Chemicals for Industry

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What's your application?

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Carrying Cases • Heels • Pen and Pencil Barrels • Key Tops • Knobs • Tool Handles • Combs • Razor Housings • Valve Parts • Pump Housings

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Dresents...

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5905

Now...everything you need in roller chain drives from Morse Chain of Canada

Morse Packaged Roller Chain
Easy to handle, convenient to use. Av
able with exclusive Spirol Pin Faster

Easy to handle, convenient to use Av
able with exclusive Spirol Pin Faster

Easy to handle, convenient to use. Available with exclusive Spirol Pin Fasteners that resist vibration and shock. Stocked in ASA standard pitches ¾" to 2½", single and multiple widths.



Morse Taper-Lock Roller Chain Sprockets

Taper-Lock construction permits quick installation, easy removal. Bushings are detachable, can be reused. Available from stock for 3%" to 2" pitch chain.



Morse Plain Bore Roller Chain Sprockets

For finishing to your exact specifications. Available in three standard types shown above. ½" to 2½" pitch, 9 through 112 teeth, and bores up to 4½".



Morse Finished Bore Roller Chain Sprockets

Save money...save time. No more reworking charges to pay; no delays for boring. Complete with keyway and setscrew for speedy installation. 216 sizes.

Only Morse offers all four: basic drives (roller chain, silent chain, Hy-Vo®, and "Timing"® Belt); speed reducers; clutches; couplings . . . plus the experience and know-how to solve your specific power-transmission problem. Contact your Canadian Morse Distributor. You'll find his name listed in the Classified Directory under "Power Transmission." Or write: Morse Chain of Canada, Ltd.—A Borg-Warner Industry—Simcoe, Ontario. Phone: GArfield 6-4960.



MORSE

Tuedomonk 1000



A BORG-WARNER INDUSTRY

Circle number 136 on time saver card



needle in a haystack?

Finding just the right spring can be costly and time-consuming. Even though springs look alike, each is different—depending on the job it has to do. Type, size, tension, temper, stress, and other complicating factors must be considered in their design and manufacture.

If finding the right spring for your problem seems like "looking for a needle in a hay-

to accept your precision mechanical spring problem and help design the *right* spring to do your job *precisely* right.

stack," let the man from Wallace Barnes

help you. Our spring engineers are ready

Send for your free copy of Spring Design and Selection—in Brief our authoritative digest on spring engineering

Selecting the right spring is simple . . .

Just call the man from





Subsidiary of Associated Spring Corporation

The Wallace Barnes Company Ltd.

Hamilton, Ontario—Montreal (Pointe Claire) Quebec Sales Agent: E. A. Tipping Sales Ltd., Winnipeg—Vancouver (Richmond)

Circle number 162 on time saver card

64-205R



YIELDS A SUPERIOR CASTING! OFFERS ADDED ECONOMIES!

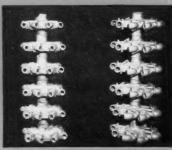
In the production of cylindrical shapes, and for small castings of irregular shape, the Centrifugal Casting Method yields a quality product much superior to that produced as a static casting.

And Shawinigan PERMA-SPUN offers significant economies over drawn tubing. Even on small quantities of any specific analysis the cost is low, and on large runs permanent molds can be used permitting a thinner wall and less machining allowance.

Centrifugal Force ensures complete freedom from non-metallic inclusions and shrinkage and creates a dense, finegrained casting with enhanced physical properties.



Centrifugally cast CF10M pipe for sulfite acid circulation systems.



Centrifugally cast stacks of CF8 fittings (as cast condition).



Centrifugally cast HU retorts magnesium production.

Illustrated are a few of the many applications of PERMA-SPUN corrosion and heat-resistant stainless steel. Consider the possibility of saving money in your operations with "Shawinigan" PERMA-SPUN centrifugally cast Stainless Steel!

*Registered trade mark.



Centrifugally cast radiant tubes and rolls for heat treating furnace — cast in permanent molds.



CHEMICALS LIMITED

STAINLESS STEEL AND ALLOYS DIVISION

Shawinigan Building, Montreal

505 Eglinton Ave. W., Toronto

Circle number 146 on time saver card

How can your customers Know

...unless your product can

COUNT?



How can they know that they're getting out of your product all the performance you build into it — unless you also build into it a Veeder-Root Counter as a standard part? Then they have a running record of performance that shows them where they stand every minute of the working day . . . and a record that proves your product's guarantee. What's more, it gives you a new plus in selling.

How to build it in? Count on us to show you. Write, or phone JAckson 7-7201.

You always "Know the score" when you count on Veeder-Root!



Vary-Tally Multiple Unit Hand-operated Counter.
Easy keyboard action. All units on same row reset instantly to zero with one turn of knob. Supplied in practically any number of units, in any arrangement.



New High-Speed Predetermining Counter, Series 1522, features instant lever reset plus quick and easy setting of predetermined number. Speeds up to 6,000 rpm. Also supplied without predetermining feature.



New "Count-Pak", a complete electronic counting package for use where high speed, long life and instant reset are required. Rated at 20,000 counts per minute (with added decade speeds run up to 200,000 cpm). Completely transistorized. Photohead adaptable to any job. Several other "Count-Paks" available.

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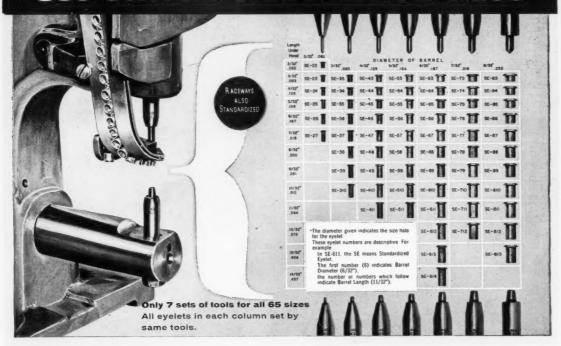
Circle number 160 on time saver card



Simplify design Speed production ave money

You can save many expensive engineering hours because designers no longer need to plow through thousands of eyelet specifications. Over 20 years' experience has shown that a very high percentage of all eyelet work can be done with the 7 United Standard diameters.

Use UNITED Standardized Sizes



Only SEVEN sets of tools needed for all 65 sizes! This means that tooling is reduced as much as 90%. With United's closely co-ordinated system of Standardized Eyelets and Eyeleting machines, eyelet grip can be increased as much as 1000% (for instance, from .093" to .437") without a single change in drill, punch, or setting tool. Result: greatly reduced installed costs and true fastener economy.

Purchasing problems are eliminated. United Standardized Eyelets are carried in stock at key points:

Low eyelet costs for you are ensured by United's constant high volume production on a relatively small number of sizes.

Inventory is greatly simplified. Fewer sizes do more jobs. Actual experience of thousands of users for over two decades has shown that United Standardized Eyelets and co-ordinated Eyeleting machines can

reduce the number of eyelet sizes carried in stock an average of 66%%.

Precision made in standard increments of 1/32" in both barrel O.D. and length, each one of the 65 United Standardized Eyelet sizes has a standard relationship in dimension and proportion to every other eyelet in the series. They are designed to save you money. Start to-day to enjoy the advantages of United's Standardized Eyelets. Write or call us for complete information.

New Eyelet Catalog Complete specifications of all phases of United's co-ordinated system of eyelets, eyeleting machines, setting tools. Also includes data on special eyelets and metal stampings.



SHOE MACHINERY COMPANY
OF CANADA LIMITED

UNITED

Industrial Sales Division

MONTPEAL

TORONTO

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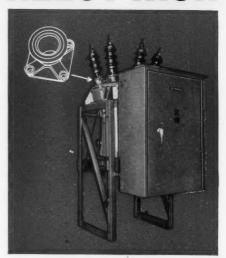


THESE BUSHINGS COST LESS WHEN CAST FROM ALLOY IRON

Canada Iron effected considerable savings in bushings for circuit breakers of Canadian Westinghouse Co. Ltd., by producing this non-magnetic conductor bushing in Ni-Resist Ductile Iron Type D2C. The bushing is used at the base of the insulators on the dome of the circuit breaker.

Canada Iron technology ensures the *right* type of casting for the job, at lower cost . . . This choice of the most suitable alloy iron is very important; it also means longer life and more dependable service. In addition, Canada Iron's on-schedule production of quality castings prevents tie-ups and costly delays.

For top flight castings with true economy and dependability, order from Canada Iron. Talk to your Canada Iron sales representative today.



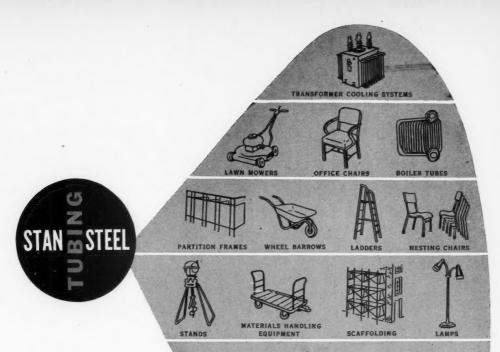




CANADA IRON FOUNDRIES, LIMITED

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product news from -

— United Steel

CORPORATION LIMITED



Nylon chain coupling will outlast metal as much as 6 to 1—costs less to buy

Specially suited for areas where heat, cold or corrosion are problems, or where quiet running is desirable, this nylon chain coupling will give as much as six times longer service life than metal couplings yet costs less to buy and maintain. Ideal for loads from fractional to 40 H.P. and speeds from 500 to 5,000 R.P.M. the nylon coupling is available for use with standard ½" pitch roller chain sprockets. Requires no lubrication and therefore no cover. Much cleaner than lubricated couplings.





Torque Limiter is compact, easily adjusted and tamper-proof

The Torque Limiter consists of a driving or driven member in combination with a spring loaded friction mechanism which may be adjusted to slip when the desired torque is exceeded. The unit is compact, easily adjusted and tamper-proof. It can be used in conjunction with any rotating member, such as sprockets, gears or pulleys. The Torque Limiter can be supplied to handle up to 620 ft. pounds of Torque.

Silent Chain is specially suited for use on precision machinery

This 3/16" pitch Silent Chain is designed particularly for applications where a smooth, positive drive is required; such as movie projectors, tape recorders, instruments and other precision machinery. It is manufactured in three basic types and is available to handle up to 5½ H.P. at 5,000 R.P.M.:

- Side Guide for standard drives with single direction rotation, chains 19/32" and under.
- (2) Centre Guide for standard drives with single direction rotation, chains over 19/32" wide.
- (3) Duplex Chain for serpentine drives, reversing secondary shaft rotation, or if an adjustable idler is required.



Roller Bearing Pillow Block for dusty operating conditions

The Type C (Dodge-Timken) Roller Bearing Pillow Block offers maximum protection where dust or other contamination is unusually severe. The Basic design consists of two Timken assemblies mounted on a slotted and threaded sleeve. These slotted ends are clamped to the shaft by means of split clamp collars. (The collars, threaded to the sleeve also provide means of adjustment). Labyrinth seals are located between the collars and the Timken Bearing. The Type C unit is completely self-aligning and provides for both radial and thrust carrying capacities. Available for shaft sizes from 1-3/16" to 5".



Flexidyne Drives and Couplings provide cushioned starting—instant overload protection

Number 5 Flexidyne Drives and Couplings were developed especially for use on light machines which may be subject to jam-ups, for example: Automatic Washers; Bottling and Canning Machinery; Automation Machinery. These light inexpensive units provide cushioned starting and instantaneous overload protection, just like the larger Flexidynes which are available to handle up to 1000 H.P.

Circle number 159 on time saver card



No. 605



Roller Chain

Precision construction and carefully tested materials are important features of this high quality roller chain. Available in all pitches and lengths, in many varieties of construction and strength for every type of transmission service.



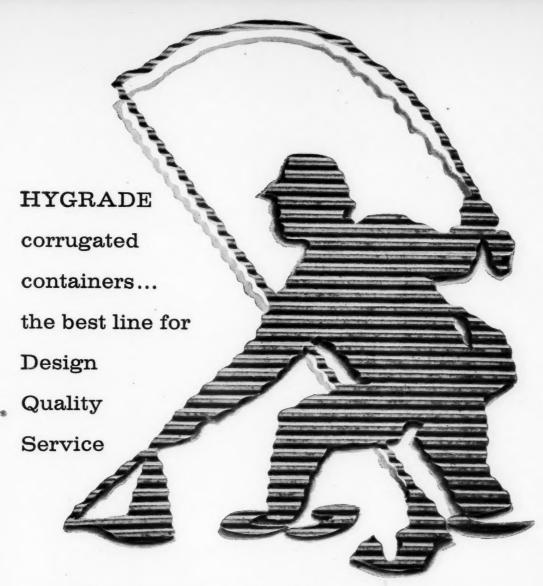
All of the items illustrated here are available for immediate delivery from stock at United Steel Corporation. Drop us a line, or fill in the coupon below for an answer to your transmission problems.

MAIL COUPON TODAY

UNITED STEEL CORPORATION LTD. 58 Pelham Avenue, Toronto 9, Ontario

P	le	ase s	end	me	descriptive	III	e	ature	on:
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DESIGN ENGINEERING MAY 1959



WHATEVER KIND OF PACKAGING PROBLEM you might have on your hands, HYGRADE Corrugated Containers is ready to wade right in and tackle it from every angle.

Every Hygrade Corrugated Container combines superior design and quality material (100% C-I-P Kraftliner), backed by Hygrade's up-to-the-minute production and service facilities. If you've been casting around for a good way to reel in more net profits, just hook up with the Hygrade Corrugated Container line. Check with the sales office nearest you.

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For containers designed to go places, call

A Subsidiary of CANADIAN INTERNATIONAL PAPER COMPANY Plants: LONDON-TORONTO-MONTREAL

Circle number 110 on time saver card



A picture of precision... 57.500 inches in diameter!

Here is an ultra-precision Torrington Radial Roller Bearing, custom-built for Wickes Machine Tool Division's 48" Center Drive Profile Lathe.

Almost five feet (57.500 in.) in diameter, it has a total inner race runout of only 0.0005 in. Its 344 rollers are held uniform in diameter within 0.00005 in. Radial capacity is 318,000 lb. at 100 rpm. Rollers are staggered in a one-piece, fully machined bronze cage for precise guidance and cool running. The bearing bore is tapered one inch per foot, and carefully mated to the spindle which was also ground by Torrington.

Such precision is possible only through specialized equipment and highly practiced skills-the same that lie behind the quality of every Torrington bearing, standard or special. Not every bearing order calls for such precision-but each is given the extra measure of care that makes Torrington quality a byword in industry. The Torrington Company, Limited, 925 Millwood Road, Toronto 17, Ont., Canada.

TORRINGTON BEARINGS

District Offices and Distributors in Principal Cities of United States and Canada

SPHERICAL ROLLER . TAPERED ROLLER . CYLINDRICAL ROLLER . NEEDLE . BALL . NEEDLE ROLLERS . THRUST

Running mate of the Torring-

ton Radial Roller Bearing

pictured is this Torrington

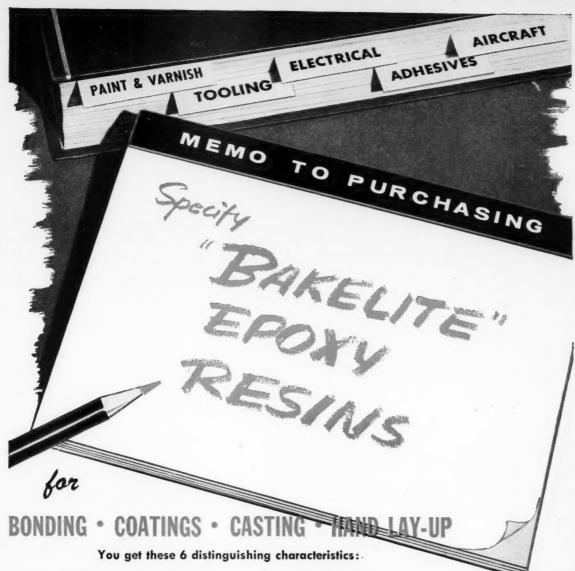
Cylindrical Roller Thrust

Bearing 52 in. OD, assem-

bled face runout 0.0004 in.,

capacity 222,000 pounds at

100 rpm.



PHYSICAL PROPERTIES

Their high mechanical strength and impact and abrasion resistance are important in tooling applications. These properties are also necessary in offering protection to delicate electronic and electric assemblies.

CHEMICAL AND MOISTURE RESISTANCE

Epoxies resist corrosion and withstand attack from many liquid and gaseous industrial chemicals, oils and greases. Impervious to moisture penetration, epoxies protect sensitive parts, such as coils and armatures.

CURING ADVANTAGES

Epoxies can cure at room temperature, thus broadening the field of application for these reactive resins. Oven size restrictions are eliminated, and capital investments and production costs are cut.

DIMENSIONAL STABILITY

Not only do epoxy tooling compounds ensure close tolerances in reproduction but they also maintain this accuracy throughout the life of the tool.

ELECTRIC PROPERTIES

Insulating resistance and dielectric strength are superior. Working life is extended and efficiency is improved when assemblies are protected by epoxy resins.

ADHESION

Ability of epoxy formulations to bond such materials as ceramics, plastics, and wood enhances the serviceability of these materials in many fields. Property particularly important in coatings where more approximate as quality of coating.

WRITE FOR

CONDENSED REFERENCE FILE

Giving more information about "BAKELITE" epoxy resins, and other plastic raw materials.

"Bakelite" and "Union Carbide" are trade marks

BAKELITE COMPANY Division of Union Carbide Canada Limited

TORONTO - BELLEVILLE - MONTREAL - VANCOUVER

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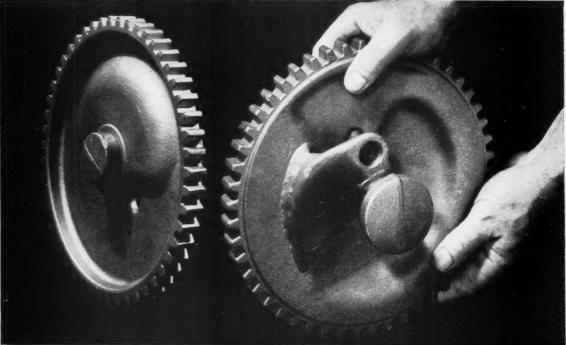
UNION CARBIDE





information

Send your request for regular mailings of the Stelco bulletin "Drop Forgings Information".



Please quote reference No. 159 when enquiring.

STELCO DROP FORGING PUTS TEETH IN GEARS

Now, Stelco forges Toothed Gears to customer specification. These gears, in common with all quality forgings, are strong, reliable, and durable, and offer substantial economies from less machine finishing. Stelco welcomes enquiries on specific applications.

Only quality steels can be successfully forged, and the process itself improves the strength of the steel by compressing its grain structure. By careful and experienced designing of the forging dies, grain flow can be controlled to fit

the contours of the forgings, resulting in much higher tensile strength and fatigue resistance than in comparable machined or cast parts.

The patented welded gear assembly shown in the unretouched photograph above was drop forged to the customer's design.

Consult Stelco's Forging Engineers to determine the savings and improvements that can be obtained through the use of forgings in *your* operations.





THE STEEL COMPANY OF CANADA, LIMITED

Drop Forge Division, Gananoque, Ontario

Sales Offices: Halifax, Saint John, Montreal, Ottawa, Toronto, Hamilton, London, Windsor, Winnipeg, Edmonton, Vancouver. J. C. Pratt & Co. Limited, St. John's, Newfoundland. 59301.8

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DESIGN ENGINEERING MAY 1959

ANACONDA COPPER PRODUCTS ARE MADE IN CANADA FROM METALS MINED AND REFINED IN CANADA

Since establishing here in 1922
Anaconda has made it a policy to
"Buy Canadian" whenever possible.
For example, we use metals mined and
refined in Canada—Ontario copper
and nickel, British Columbia lead and
zinc, Manitoba zinc. We give preference to Canadian suppliers of gas,
machinery, lumber and many other

manufacturing requirements.

Specify "Anaconda"— Canada's most complete range of copper and its alloys in the form of sheet, strip, tube, rod, special wire and extruded shapes. Anaconda American Brass Limited, New Toronto, Ontario. Sales offices, Montreal and Vancouver.

C-5922





Give Preference to Canadian Products Whenever Possible

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If forgings are a component,
your product can be better, stronger, safer because of
the <u>big extras</u> in Dominion's forgings

Lower manufacturing costs, a superior product, little if any need for field service and repairs are what you expect—and get—when one or more of your product's components are forged.

Something else on which you can count is a better, stronger, safer product if your forgings are from Dominion Forge Limited, one of North America's great forges.

While Dominion's forging and auxiliary facilities cannot be matched for versatility by any other commercial forge on the continent, that's simply a guarantee of service. Dominion's insistence on a standard of quality unsurpassed in its industry is what assures a consistency of quality that is equally unsurpassed. It's a big extra. A big extra that adds up to a better, stronger, safer product. A big extra that costs you nothing extra!

Your Dominion Forge forging engineer's first responsibility is to help you get all the extras in forgings Dominion delivers. Put his training and experience to work for you. You'll find it pays.

DOMINION FORGE LIMITED



MEMBER: DROP FORGING ASSOCIATION

2480 Seminole Street, Walkerville, Ontario, Canada Telephone: CLearwater 4-7545 • Cable Address: Domforge

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FREE! Handy informative guide that ought to be at your elbow. Dominion Forge's DATA BOOK ON FORGINGS, packed with useful facts, illustrates and describes Dominion's unique facilities. Write for your free copy. No obligation, of course.



DIE SINKER Ernie Berthiaume is one of over 125 members of Dominion Forge's Quarter Century Club—an aggregation of forging experience on which you can count.

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comes you to the

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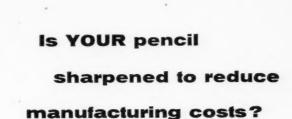
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COMPANY'S BUSINESS OR PRODUCT. YOUR HOTEL For additional show tickets, and conterence information write to: Clapp & Poliak, Inc., 341 Madison Ave., N. Y. 17, N. Y.



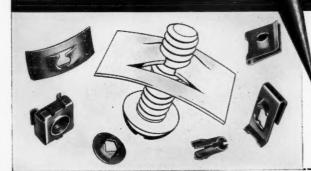
There are a lot of sharp pencils in use these days
— production costs must be kept in line to meet increasing competition. Speed Nuts are specially designed fasteners that save time and money on every assembly operation. There are 8,000 kinds now in use, and we will gladly design types to meet your special needs.

If you're interested in lower costs you'll be interested in

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7 Speech Mutis

Exclusive TINNERMAN Canadian Licencee



DOMINION FASTENERS LIMITED

a Geo. A. Tinnerman corporation

HAMILTON, ONTARIO. Sales Branches: Toronto, Montreal

Like most manufacturers, I want to get my production costs down. Please rush complete information on how Speed Nuts can help me.

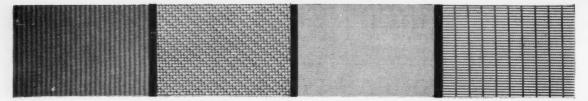
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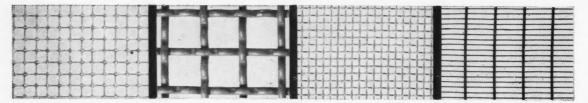
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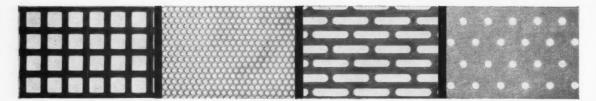
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WIRE SCREENS



PERFORATED METALS



Over one thousand types in stock

If you need screening—call Greening! They have the size and type to meet your needs exactly, whether you use it for processing or as part of a finished product.

Materials include steel, aluminum, bronze, brass, copper, inconel, monel, nickel and stainless steel. Weaves include plain, twill, and dutch. Sheet metals are perforated in all commercial materials, gauges and hole specifications. You can be sure that Greening has the type you need—and you're sure of prompt delivery, too.

Greening sales engineers will gladly help you with the selection of the best screens or perforated metal for your requirements.

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You draw sharper, clearer with Eagle Turquoise

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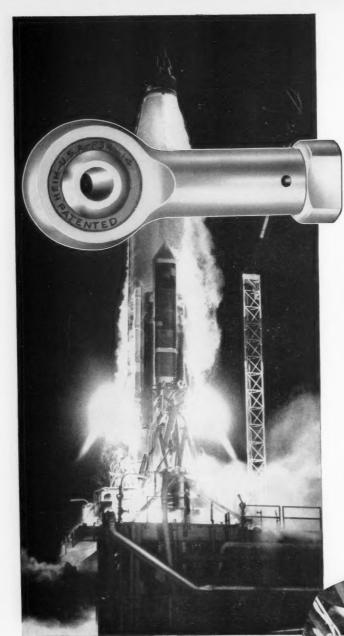
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The Mighty Atlas is built and test-flown for the U.S. Air Force by Convair (Astronautics) Division of General Dynamics Corp.

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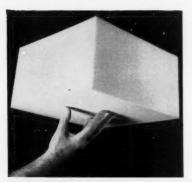
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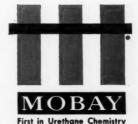
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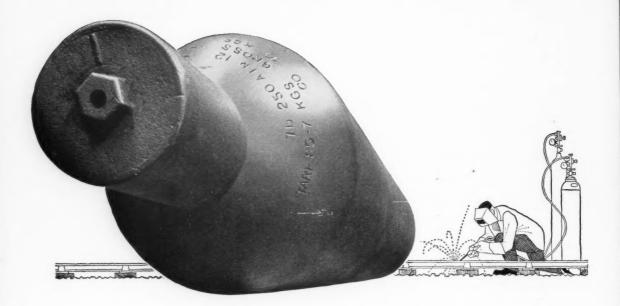
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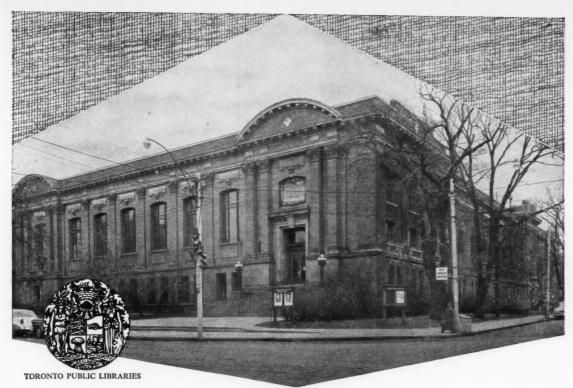
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Public Library Reports

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Last year 58,000 people used The Hallam Room at the Toronto Public Library. On file there are issues of several hundred Canadian business papers and house organs. A survey of 6000 firms in Toronto showed 45% consult the library 1 to 5 times a year and over 75% of the information they want is found in business and trade publications. The story is much the same in most large Canadian libraries.

The McGill University Library School Documentation Seminar 1958 stated: "The pre-eminent position given to business publications has long been recognized... libraries have for many years devoted attention to providing the widest access to business publications".

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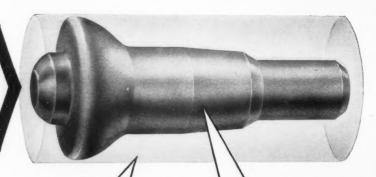


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*In one recent instance speed of production was increased from 30 per hour to 6000 per hour by converting from automatic screw machine production to cold heading.

Design Engineering

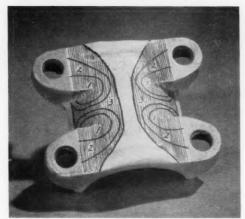


Fig 1 — Brittle lacquer tests produced results



Fig 2 — Old design: notice ribs, ears, centre hole.



Fig 2 — New design: 35 per cent stronger than old.

Casting redesign: a study in strain patterns

Louis H. Ravitch

Improving the design of iron castings and developing new applications for foundry products underlie the work of engineers, at Central Foundry Division of General Motors Corporation. This division manufactures ArmaSteel malleable iron, and grey iron castings for cars, trucks, diesel engines and non-vehicle applications.

To illustrate how strain readings are used in studying a casting design, take the case of the U-bolt anchor plate for an axle application (Figs. 1 and 2). The part was cast of ArmaSteel and designed to accommodate two U-bolts to secure the rear spring to the axle. The casting was coated with brittle lacquer and the calibration bar indicated that the lacquer would crack at a strain of 400 micro-in. per in. The coated part was placed in a test fixture in the laboratory and simulated service loads applied. As the torque loads on the part were increased, cracks in the lacquer appeared in several areas and in several patterns (Fig. 1).

Object of tests

One of the objects of this test was to determine whether the U-bolt anchor plate would safely withstand a torque of 75 ft-lb on each of the U-bolt nuts, during assembly by the truck manufacturer. Therefore, loadings in increments of 25 ft-lb were applied during the test. A load of 25 ft-lb applied to each of the four nuts caused the first cracks in the lacquer to appear. The areas of these first cracks (Area 1) were the areas of maximum strain on the bracket, since they were the first to show crack patterns. By referring to the calibration bar for this test, these first cracks also meant that the strain in these areas was 400 micro-in. per in. Loadings were increased to 50 ft-lb and 75 ft-lb which produced additional patterns of cracks in the brittle lacquer, as shown by Areas 2 and 3, respectively. The stresses in the casting were then determined in accordance



Fig. 6 — Stamping (left), becomes a casting (right).

with Hooke's Law:

s = eE

where s = unit stress (psi)

e = unit strain (in. per in.)

E = modulus of elasticity (psi).

= 27 x 10⁶ psi for Arma Steel

Therefore, $s = 400 \times 10^{-6} \times 27 \times 10^{6}$

s = 10,800 psi.

The stress level in the areas where the cracks first appeared was thus 10,800 psi for an applied torque of 25 ft-lb. The stresses in the second and third areas resulting from applied torque loads of 50 and 75 ft-lb were calculated (by direct scaling) to be respectively 21,600 and 32,400 psi.

To complete the test, torque loads beyond 75 ft-lb were applied. The U-bolt anchor plate did not yield, indicating that it was more than adequate for the

assembly requirement.

This information from brittle lacquer tests aided in the redesign of the U-bolt anchor plate (Fig. 2). The original design (cast of malleable iron) weighed 2.25 lb while the new design, (of GM 86M ArmaSteel) weighed only 1.30 lb. The ribs were moved from the outside of the casting to the inside, to put them in compression and not tension. A centre hole was eliminated. The resulting casing was 35% stronger.



Fig. 7—Gusset type rib left is dropped on new design.

Design Principles. In the design and manufacture of cast products, there are a number of fundamental principles for designers to follow. These design principles are summarized in Fig. 3.

In addition, some foundry principles are shown in

Fig. 4

Examples. Parts redesigned through the use of stress analysis and good foundry practice are: (a) a rear spring clip pad used on a rear axle to clamp the spring to the axle and to support the shock absorber arm (Fig. 5);

(b) a pulley idler arm used for V-belt tightening adjustment on cars equipped with a compressor for air

suspension (Fig. 6);

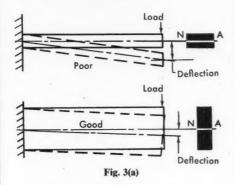
(c) a bumper support bracket used to support the front bumper of a passenger car (Fig. 7). The rear spring clip pad was changed from a metal stamping to an ArmaSteel casting, with a saving in weight and improved strength for this application. Similarly, the pulley idler arm was changed from a stamping to a casting, with increased rigidity as one of the results. The bumper support bracket was redesigned to reduce the weight and cost of the casting.

Mr. Ravitch is stress analyst with the Experimental and Development Dept., Central Foundry Division of GM.

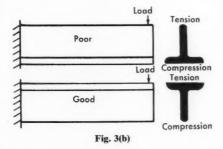


Fig 5 - Vehicle rear spring clip pad: product improvement changed stamping (left), to casting (centre and right).

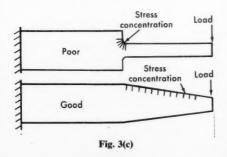
For maximum strength have the material located away from the neutral axis (NA). Fig 3(a) shows two bars of equal cross-section and length, built-in at the left-hand end. In the upper figure, the bar is mounted flat, while below it is mounted edgewise. Under equal loading the second bar will, of course, deflect less, because of its greater moment of inertia.

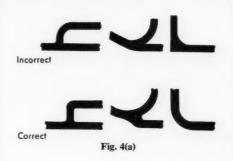


Have the flanges in tension and the webs in compression wherever possible. Fig 3(b) compares two mounting arrangements. In the lower figure, the flange is in tension and the web in compression. This is desirable, because the compressive strength of most materials far exceeds the tensile strength. The flange (which distributes the load over its entire surface) is more effective in tension than in compression. The web, on the other hand, has its maximum stresses concentrated on the narrow portion of the outermost fibres. Therefore, the webs are thus more effective when in compression.



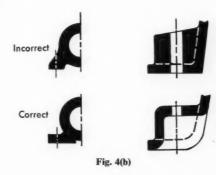
Use smoothly tapered sections to prevent high stress concentration. Fig 3(c) lower shows the preferred design, to avoid the severe stress concentration that occurs at the sharp corners in the upper figure.



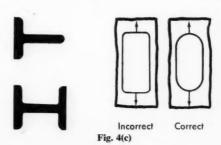


At adjoining sections, avoid sharp corners and abrupt section changes by using fillets and blending radii. Fig 4(a) shows several examples of incorrect and correct design concerning sharp corners and adjoining sections. Fillets and blending radii serve two functions:—

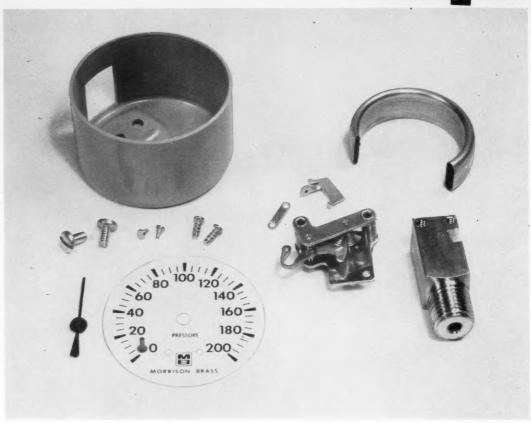
(i) they reduce stress concentration in the casting, and (ii) prevent tears and draws at re-entry angles and "hot spots" which may cause local weakness and cracking as the molten metal cools. In addition, they also make the corners easier to mold.



Keep casting sections as uniform in thickness as possible [Fig 4(b)]. Heavy casting sections may present acute metal feeding problems, while uniform sections save weight, material, machining costs, and often result in a stronger casting.



Design the ribs and brackets for maximum effectiveness [Fig 4(c)]. T- and H-shaped ribbed designs have the advantage of uniform metal sections for uniform cooling. Avoid rectangular holes in ribs or webs; use oval holes with the longest dimension in the direction of the stress.



Pressure gauges using a Bourdon tube

This is a fresh, practical approach to the designing of pressure gauges

Mainly historical

Prior to the 1840's, the measurement of pressure was relatively inaccurate and certainly unsatisfactory, but fortunately there was no need for accurate measurement. In those days, they used either a mercury column, the measured compression of air in a tube or a spring-loaded piston in a cylinder.

In England, with the advent of railways and the rapid development of industry, the problem of pressure measurement became acute. Attempts were made to improve the accuracy by using various diaphgrams, without success.

In 1849, Eugene Bourdon of Paris (and Schinz of Cologne) patented a revolutionary method, the essential element of which was eventually called "The Bourdon tube."

Today, pressure gauges using the Bourdon tube are being made by the million.

James D. Orr

It seems startling (particularly after 100 years of development) that even today, Bourdon tubes are designed by rule-of-thumb methods. There is still comparatively little literature on fundamental design or theory. This scarcity of technical data leads to the conclusion that Bourdon tube manufacturers jealously guard the empirical data developed over the years for designing these various tubes.

The difficulty (and perhaps futility) of a mathematical approach becomes apparent when we consider what is actually happening in the tube when pressure is exerted. The tube reacts somewhat to temperature differentials. Under pressure, it tries to change from an oval to a circular cross-section: the longitudinal resultant tends to lengthen the tube. The most efficient cross-section for avoiding stress concentration is an ellipse.

The cross-section of the tube changes and so does the bend radius. The loads are both radial and perpendicular to this cross-section. A true elliptical crosssection is never obtained in production, and the radius of curvature isn't the same from point to point in the tube.

We do know from practice that, changing the bend radius, the minor axis, the length of tube and the angle included between the ends, changes the deflection rate in definite proportions within certain limits.

Further, knowing that we have to reduce a set of continuously changing physical dimensions to an instantaneous static condition long enough for mathematical analysis, we can assume that trial and error (combined with experience) will give us the tube we want perhaps a little faster. In many cases this is true, but the range of deflection is limited in which pressure is proportional.

Also, the power of the tube must be sufficient for the work involved. It must be powerful enough to overcome the drag of the multiplying mechanism (the movement) otherwise the tip will be delayed in reaching the correct point. It must also nullify the effect of hairspring loading (to take up the gear backlash), which acts as a drag only for rising pressure, and a push (or help) for falling pressure. For this reason, there is usually a take-up at the bottom of the dial where the drag is much higher in proportion to the strength of the tube. Zero readings are thus always inaccurate.

Designing a new gauge

When approaching the design of a new gauge, we are confronted with the following problems:

- (a) What is the pressure range?
- (b) What are the space limitations?
- (c) What is the usable tip travel desired?
- (d) What accuracy is required?
- (e) How much power or energy must be supplied to overcome movement?
- (f) What is the type of application? What about corrosion and pressure fluctuation?

To clarify our approach to the design of a new gauge, we will consider the new 2-in. and 2½-in. drawn-steel-case, inexpensive gauge that we recently designed. It consists of a brass barstock socket (1); a non-bushed, suspended type brass movement with

gooseneck (2); trumpet-brass Bourdon tube (3); soft soldered to the socket; and a brass tip (4) soldered to the other end of the tube. This assembly is mounted in a drawn-steel case, with a steel lithographed dial (5); aluminum pointer, glass, and a somewhat unusual plastic extrusion (6) for fastening the glass in place.

Tube widths

For some years now, the trade has been trying to standardize on tube widths. They have not been too successful to my knowledge, but have got as far as these: A—1 in. or 1/8 in.; B—3/4 in.; C—5/8 in. or 1/2 in.; D—3/8 in.; E—1/4 in.

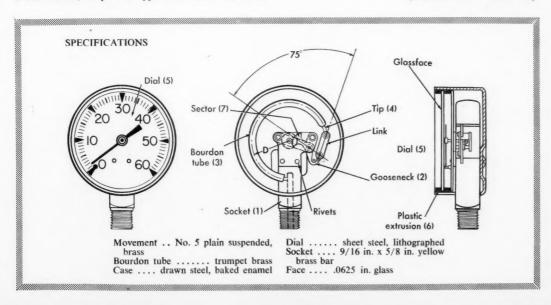
The width of the tube is important and should obviously be standardized. As it increases, there is more area offered for the pressure to act on and thus a greater wall thickness is needed for the same pressure. As the pressure range goes up, the width must be reduced, to keep the wall thickness reasonable. A thick wall makes the tube very rigid with a low fatigue limit. Too light a wall, on the other hand, is also bad because it may be too weak, too flexible, too sensitive and not strong enough to overwhelm the movement.

Both sizes of the gauge use the same movement, but have different tubes. The pressure range was vacuum to 15, 30, 60, 100, 200, 300, 400 and 600 psi. It was possible to combine certain tubing between the two sizes and often it was found that a tube suitable for the 2½-in. gauge at a certain pressure could be used on the 2-in. at a higher pressure, thus enabling the manufacturer to purchase and use the same tube extrusion but vary its length and bend radius to suit the gauge size. It was desirable to maintain the largest tube diameter that could possibly be contained in the case and the greatest arc of tube length, both for accuracy and sensitivity.

As shown in box (a typical arrangement of the Bourdon tube pressure gauge) the tube is the essential element. The tube is fastened to the socket either by soft soldering or brazing, depending on the pressure and material.

In the vacuum to 15 and 30 psi types, the 5/8-in.-

(continued overleaf)



wide tube was used; the $\frac{1}{2}$ -in. tube was used for higher pressures.

The use of a %-in.-wide tube for the lower pressures is not common in the industry for an inexpensive gauge, but we consider the additional expense warranted, to maintain accuracy and sensitivity. Since the ½-in. pipe thread was standardized for the socket, its dimensions had to be 9/16 in. square as a minimum. We used % x 9/16 in. because it enabled us to complete the total line with one barstock size and one case depth, a very desirable feature in Canada's relatively small market.

The tube wall thicknesses varied all the way from .004 to .015 in. depending on the pressure. On a Bourdon tube of any pressure range, the tip travel gets less and less per pound as it increases in total.

An important discovery

A secret was disclosed which enabled us to design a very accurate and dependable action; that is, an ideal angle of 75 deg should be maintained between the sector pivot (7) — gooseneck hole line with the tip hole or, the angle of link to sector at zero travel.

With this ideal angle, the movement will compensate and speed up as it approaches 90 deg. A thick wall on the tube gives less fatigue strength and smaller tip travel. This necessitates a higher gear-ratio for the movement. This in turn multiplies errors and is hard to calibrate. The narrower tube, therefore, in our higher pressures enables us to reduce the wall thickness and we strived for the same tip travel over the complete pressure range.

Empirical data at our disposal enabled us quickly to arrive at the correct wall thickness for the various pressures, having first established our tube width and arc diameter.

We selected trumpet brass as the material, because it is quite adequate for pressures up to 600 psi. Had we gone above this (to 1,000 psi) we should have used phosphor bronze and beryllium copper up to 3,000 psi.

This inexpensive gauge can be made and sold at an incredibly low price (approximately \$1.00) and at such a price can truly be considered as a throw-away instrument. Thus in our design directive we did away with the provision for repair and part replacement. The sensitivity of these gauges is such that an aluminum pointer was required, because of its lighter weight.

Conclusion. There are many other interesting aspects of gauge design. For example, the tube material used for various applications and pressures is a science in itself; socket design for expensive gauges; movement design; soldering techniques of various materials and pressures.

The user of production gauges cannot expect greater accuracy than 2%. On the laboratory gauge, he should expect at least ½% and in most cases ¼%. There are many causes of gauge failure, the foremost being rapid pressure fluctuations, but there are available pressure snubbers to fit into the socket and throttle (or dampen) these fluctuations. Vibration can wear out moving parts and movements very rapidly, and over-pressure can permanently stretch the tubing. The sudden release of pressure damages the movement, whilst corrosive conditions will rapidly destroy a gauge not specified for this atmosphere.

It is well for the purchaser of a gauge to consult the manufacturer on his particular applications. An inexpensive gauge can often be used for applications hitherto considered in terms of an expensive one. On the other hand, it is foolish to expect too much of the small throw-away type gauge, in the way of long life and accuracy under a wide variety of conditions. Under normal operating conditions, however, the throw-away type can be most effective and dependable. **

Mr. Orr is a partner of Orr Associates, Consulting Product Planners, Designers and Engineers, Toronto.



This is the suspended type brass movement with gooseneck referred to as (2) on line drawing on the preceding page.



An unusual plastic extrusion, see reference (6) is used for fastening the glass of the pressure gauge in place.



Design Engineering Show-Philadelphia

A DE Show Preview

Eric Haworth Assistant Editor

Nearly 30 Canadian companies will be showing their products in the Design Engineering Show in Philadelphia, Pa., May 25 through 28.

To be sure of Canadian representation, the Department of Trade and Commerce, Ottawa, booked 1,000 sq ft of space to be given over to Canadian industry. Among the items featured will be a cutaway model of the Orenda 11 engine, the Ontario Research Foundation's plastic wheel, and a new Cobalt 60 irradiator.

The \$10 million show will be held in the Convention Hall, Philadelphia, and altogether some 12,000 products will be exhibited. A basic function of the show is to help research and development engineers plan for the products of the 1960s. Every kind of manufactured product will be displayed from coffee pots to solar satellites, from electronic computers to hydraulic presses. Metal alloys, plastics, synthetic rubber, fasteners and adhesives, finishes, and hydraulic and pneumatic equipment.

Executives and engineers from the world over will converge on this, one of the largest and most important industrial expositions on the U.S. calendar. (The show was begun in Philadelphia three years ago—has since

been held in New York and Chicago.)

Honeypot for engineers will be the four-day conference staged by the machine design division of the American Society of Mechanical Engineers (see page 00 for details). Sessions on the choice of materials in design, mechanical aspects and the power and control of design, are planned.

A session will be devoted to engineering design overseas. Spotlight will be turned on the technical education of German engineers, the role of the engineering executive in that nation's industry and the loss of engineering talent to the USSR.

To cope with the scores of thousands of inquiries for "more information" that will result from the show, an engineered approach has been taken. On registration, the show visitor will receive a small plastic plate on which is embossed his name, title, company and address. When he sees something he'd like information about—he just hands his plate to the exhibitor. This official then inserts the plate in a small printing device and the inquiry is automatically inscribed.

DE editors will be in Philadelphia to cover the show and look forward to meeting you there.



1959 Design Engineering Conference details

MONDAY, MAY 25

"Engineering Design Overseas." Cochairmen: Dr. Joseph W. Barker, chairman of the board, Research Corp., New York, and Carl W. Besserer, assistant program director, Minuteman Project, Space Technology Laboratories division, Ramo - Wooldridge Corp., Los Angeles.







"Engineering Design in Germany." Speaker: Hellmuth Walter, director of research, Worthington Cop., Harrison,

TUESDAY, MAY 26 (CONCURRENT SESSIONS)

"Materials." Co-chairmen: John C. Redmond, consultant, Pittsburgh, and Robert N. Peterson, supervisor, application design group, E. I. duPont de Nemours & Co., Inc., Wilmington, Del.

"Latest Developments in Plastics for High Temperature Service." Speaker: Irving J. Gruntfest, materials studies, Aerosciences Laboratory, missile and space vehicle department, General Electric Co., Philadelphia.







"Latest Developments in Metals and Ceramics for High Temprature Service." Speaker: Julius J. Harwood, head, metallurgy branch, Office of Naval Research, Department of the Navy, Washington, D.C.

"Power & Control." Co-chairmen: Donald G. Dutcher, chief electrical engineer, Hanson-Van Winkle-Munning Co., Matawan, N.J., and R. W. Barnitz, chief electrical engineer, Jones & Laughlin Steel Corp., Pittsburgh.

"Variable Speed DC Drive Systems." Speaker: M. H. Sluis, electrical engineer, Pratt & Whitney Co., Inc., West Hartford, Conn.











Jackson

"DC Conversion Devices." Speaker: J. J. Rheinhold, vice-president, Richardson-Allen Corp., College Point, N.Y.

"Mechanical." Co-chairmen: Francis L. Jackson, technical director, Franklin Institute Laboratories for Research and Development, Philadelphia, and T. R. Rideout, consulting engineer, Port Chester, N.Y.

"Design and Application of Belts, Chains and Gears." Speakers: E. S. Cheaney, W. C. Raridan and C. L. Paullus, principal engineers, product development division, Battelle Memorial Institute, Columbus, O.







"Clutch-Fluid Coupling-Torque Converter, Application Considerations and Performance Comparisons." Speaker: Robert W. Bachmann, application engineer, hydraulic division, Twin Disc Clutch Co., Rockford, Ill.





WEDNESDAY, MAY 27 (CONCURRENT SESSIONS)







- "Materials." Co-chairmen: Dr. E. H. Phelps, assistant division chief, chemical-metallurgy division, applied research laboratory, U.S. Steel Corp., Monroeville, Pa., and R. V. Vanden Berg, head, finishes section, process development laboratories, Aluminum Co. of America, New Kensington, Pa.
- "Latest Developments in Materials to Resist Chemical Corrosion." Speaker: S. W. Shepard, materials engineer, Chemical Construction Corp., New York.







Safranek

- "Latest Developments in Materials and Coatings to Resist Atmospheric Corrosion." Speakers: E. Burt Friedl, principal chemist, corrosion research division; Louis J. Nowacki, assistant chief, organic coatings research, and William H. Safranek, assistant chief, electrochemical engineering division, Battelle Memorial Institute, Columbus,
- "Power and Control." Co-chairmen: Jay W. Picking, manager, control division, Reliance Electric and Engineering Co., Cleveland, and A. M. Kimball, manager, digital control engineering, director systems department, Westinghouse Electric Corp., Pittsburgh.











Fuller

- "Digital Systems for Control Applications." Speaker: Isaac L. Auerbach, president, Auerbach Electronics Corp., Narberth, Pa.
- "Logic Circuits for Machine Control." Speaker: Edgar V. Weir, consulting engineer, Magnetics, Inc., Butler, Pa.
- "Mechanical." Co-chairmen: Dudley Fuller, professor, mechanical engineering

1959 Design Engineering Conference details (continued)

department, Columbia University, New York, and Stanley Abramovitz, presi-







dent, Continental Bearing Research Corp., New York.

"Design Curves for Journal Bearings." Speaker: Donald F. Hays, research engineer, mechancial development department, research laboratories, General Motors Corp., Warren, Mich.

"Which Bearing and Why?" Speaker: Arnold O. DeHart, research engineer, mechanical development department. research laboratories, General Motors.

THURSDAY, MAY 28

"General Engineering." Co-chairmen: Thomas W. Hopper, president and director, Day & Zimmermann, Inc., Philadelphia, and G. L. Broomell, director of engineering, Leeds & Northrup Co., Philadelphia.







"A Graphic Method for Engineering Organization." Speakers: E. M. Ramberg, vice-president-engineering, and Randolph P. Dominic, assistant to vicepresident-engineering, Titeflex, Inc., Springfield, Mass.

"The Man and the Organziation." Speaker: Dr. Martin M. Bruce, vice-president and director, psychological services, Clark, Channell, Inc., Stamford, Conn.

Some of the Canadian exhibitors at the DE Show



The Canadian Research Institute will be showing this insulation resistance test set (above) together with their geophysical potentiometer. Note the cabinet design.



Table model of the De Havilland DHC-4 Caribou is en route to the DE show. Aircraft has "new look" due to lengthening of fuselage ahead of the wing by 45 inches.



Plastic wheel developed by the Ontario Research Foundation will be up-front in exhibits. Wheel is made in two halves each 23 in. diameter, pie-shaped section.



As the sign indicates, Jarry Hydraulics plan to display the nose landing gear of the Caribou at the Philadelphia show. (Full technical details in Feb. 59 issue of DE).



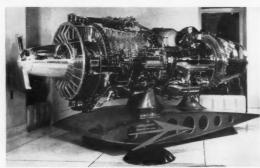
Metal bonding autoclave produced by Pathex (Canada) Ltd. will be shown in model form. Working unit is 30 ft long and operations are handled by 20 ft control console.



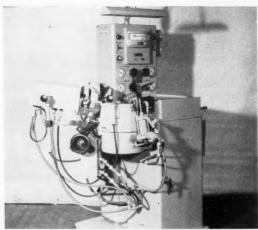
Laboratory size gamma irradiator has a 220 cubic inch samples chamber, pushbutton operation with automatic removal of sample. Atomic Energy of Canada Ltd.



On the Canadian stand at the show will be this Dual-Aire ventilator produced by Canada Fans Ltd. The unit exhausts and supplies air in this one single installation.



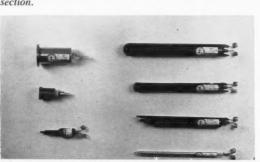
The series 11 Orenda turbojet engine in cutaway form all ready for the show. Unit has been shown in Germany, France, U. K. as well as in U. S. and Canada.



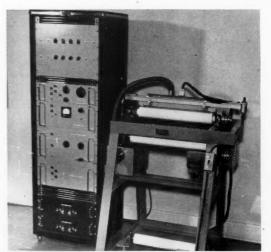
Semi-automatic assembly die casting machine. Fisher Gauge Works Ltd. have just put out this new model which is expected to attract wide interest at Philadelphia.



Miscellaneous rolls and products from the B & K Roller Die Co. will be shown including a final pass stand taken from a roll forming machine, and an actual finished section.



Electronics Associates Ltd. plan to include this exhibit of geiger tubes together with some of the equipment from their recently developed vehicle identification system.



Nash and Harrison Ltd. have been approached to display their electronic detection machine. At left, control cabinet and next to it, the stand with single unit head.



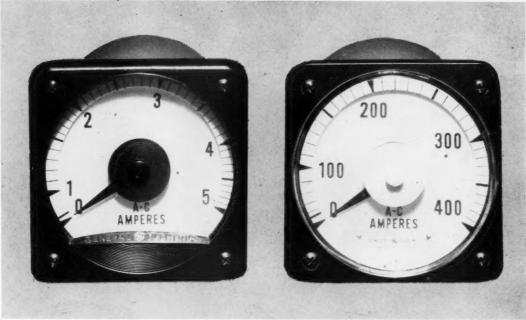


Fig 1 - Notice shadows from overhanging bezel (left). Domed glass, making scale plate flush with bezel, helps.

A scale-plate needs great sensitivity

Shadows, glare, illumination — all these must be considered in design

A. Opstad

(1) Illumination. Proper illumination is a prime consideration. To achieve this, a light source giving an illumination of at least 30 foot-candles is recommended. A fluorescent or indirect light gives the best results. When an instrument is to be used in a dark place, it can be internally lit. This practice is not to be recommended, however, as internally-lit instruments are difficult to illuminate uniformly and thus cause glare on the scale plate.

(2) Scale plates. When a flat scale plate is used, parallax errors can occur. To eliminate them, the line of sight and the instrument pointer must be in a plane perpendicular to the scale plate.

> An instrument must be sensitive to the quantity to be measured and transmit an indication proportional to that quantity. The accuracy with which this indication can be read depends on the observer and on the design of the scale-

> Some of the factors that go into scale-plate readability are given here.

On many of the more accurate laboratory type instruments, a mirror is located behind the pointer and usually flush with the scale plate. The person reading the instrument visually lines up the pointer with its image in the mirror. This makes certain that the line of sight is perpendicular to the scale plate and so eliminates parallax errors.

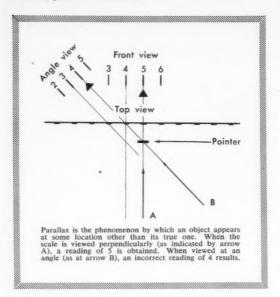
With this type of scale plate, readings cannot be taken from an angle, but must always be taken from a position directly in front.

On many instruments, antiparallax scale plates are used. This permits the added convenience of being able to read the instrument from varying angles. In this design, the rim of the plate bearing the calibration marks is raised, so that the tip of the pointer is in the same plane as the rim. Readings can thus be taken at an angle without any danger of parallax. In switchboard stations, for example, many of the dials are large enough to be read from a distance of 10 or 20 ft. This added feature can be very useful.

(3) Shadows. Are eliminated by designing the instrument so that the scale plate stands out, both from the instrument cover bezel and the surrounding panel boards. (Fig. 1)

(4) Glare. Is caused by an improperly distributed light source. (see Fig. 2 overleaf)

A special type of antiglare glass can be used to reduce glare to a minimum. This is obtained by carefully etching one side of the glass. The etching must



be very slight, so as not to impair the transparency of the glass.

(5) **Printing.** For clarity, only essential information should appear on the scale plate and the printing should provide a clear contrast between the different numerals. A gothic type of numeral gives the best results. The size of the number depends on the distance from which the scale is to be read. The exact size and shape of numeral can be best determined by referring to the chart (right) showing optimum height-to-width ratios.

The dotted curve shows that a height-width ratio of 1.0 is best when the numeral height is limited (width variable), while a 1.8 to 1 ratio (see solid curve) is best when the width of the numeral is limited. Best results are obtained when the breadth of the line forming the numeral is 1/6 to 1/8 the height of the numeral, and

Fig 2—Shows glare caused by an improper light source.



the spacing between numerals is approximately ½ the width of the numerals.

In cases where it is desirable to have more than one set of numerals on the scale plate (in order to accommodate more than one current transformer or potential transformer ratio) numerals should be selected so that only one set of calibration marks is required.

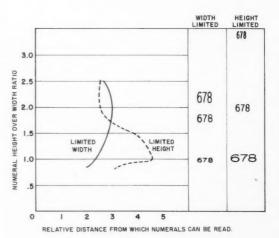
PRINTING SCALE PLATES.

Two common methods are:

Silk screen process.

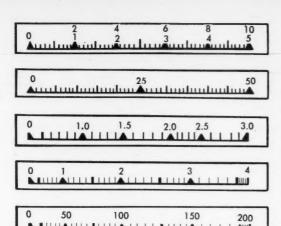
An enlarged copy (usually four times actual size) is made of the printing desired. This enlarged copy (master) is then photographed, using a reducer to obtain an actual-size negative of the printing. A contact positive is made from the negative; this positive is then used to make an emulsion. In making the emulsion, the positive is placed in contact with a sensitized gelatinous compound. By means of light, this compound is activated in the exposed parts to form the relatively firm emulsion.

The unexposed part (printing) is still soft and can be washed out, leaving void spaces through which paint can be pressed onto the scale plate.



A taut silk screen placed in a frame serves as a firm (but somewhat flexible) support for the emulsion, which adheres to it.

The process is best suited to production where large numbers of similarly numbered scale plates are required. The initial cost is not too great, but the upkeep is high. A different screen is required for each scale plate marking. When using these screens, only the numerals and the printing on the scale plate is put on. In order to do this, the proper location of the numerals must be known in advance. The life of these screens is largely determined by the care with which they are used and by the size of the smallest printing to be screened onto the plate. There is difficulty in obtaining a clear reproduction when the printing is small. The screens cannot be stored for long periods because the silk strands become brittle and crack when used again.



Hot press process.

60

30

The initial cost is somewhat higher, but the system is much more versatile and is thus used when a diversity of scale plate printings is required. For this process, the scale plate is heated and metal numerals press a black ribbon onto the scale plate. Under heat and pressure, the ribbon partially melts and the numerals are deposited on each scale plate. (See Fig. 4)

120

150

(6) **Scale marking**. Calibration marks should be selected so that each division is equal to 1, 2, 5, or numbers that are derivatives of these (such as .01, .02, .05 or 100, 200, 500). (as shown above)

Never use more than four minor subdivisions between major marks. For example, the type of marking in line 2 is undesirable, for there are five minor subdivisions in each of the two major subdivisions, and it thus takes time to figure out the value of each minor subdivision. The value of the smallest subdivision should not be less than the accuracy of the instrument itself. Assume that a scale of 0 to 100 is used on an instrument that is accurate to 1% of full scale. In this

Fig 3—Printing of scale plates is by silk screen process.



case, the value of the smallest subdivision should be not less than one.

(7) Scale plate coloring. Best results are obtained when there is maximum contrast between the numerals and the scale plate face. In general, the use of black figures on white is recommended. When dials are mounted on panels, the reflection factor of the panel should be about half-way between that of the dial-face and the general surroundings.

(8) Cover glass. A flat (or slightly curved) glass gives the least distortion, but the use of a flat glass means that the scale plate must be set farther back into the instrument. In order that the scale plate can be still extended out to the plane of the outer edge of the bezel, a dome-shaped type of glass is used. While this does have some distortion at extreme angles, it does away with the overhanging bezel. (See Fig. 5) *

Mr. Opstad is instrument design engineer with the Quebec plant of Canadian General Electric Company.

Fig 4 - Numerals being applied by hot press method.

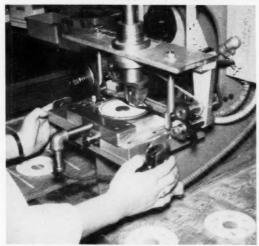


Fig 5 — Less distortion by using sharp corner on glass.





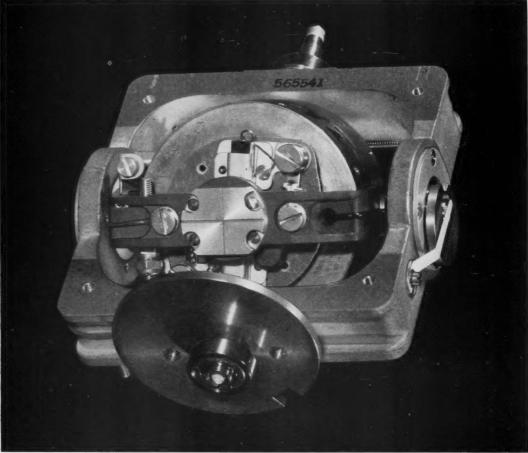


Fig 1-The caging mechanism for a directional gyro (underside). Follower drops into square-cut slot, bottom right.

Modern applications for that old cam

Cams, ancient and modern

Although most people in the design field have become accustomed to the idea that very few of our modern developments are entirely original, there is still the ego-shattering experience of finding that some development (which you have considered to be absolutely unique) is, in fact, hundreds of years old.

This article shows some modern applications of one of man's most ancient engineering devices, the cam. The first use of a cam is lost in the mists of antiquity, but it was most likely developed shortly after the wheel, maybe as a result of the difficulty of accurately positioning the centre hole.

Larry Eggleton

Fig. 2(a) shows the simplest form of cam; an eccentric plate and a push-rod follower riding on its rim. This principle is used on the camshaft that operates the exhaust and inlet valves of an automobile engine. There is, of course, a considerable amount of friction developed at the point of contact in this simple form; the next step (to eliminate this) exchanged the sliding motion for a rolling motion.

Fig. 2(b) shows how the friction can be reduced practically to zero by installing a small roller on a ball-bearing shaft at the point where the push-rod previously touched the cam. In most uses of a simple cam like this, the idea is to convert rotary motion (of a shaft) into reciprocation motion, the form of which will depend on the shape of the cam.

The reduced friction made possible by the ball-bearing roller allows the operation to be reversed; in other words, instead of the cam pushing the follower, pressure applied to the follower causes the cam to

turn. The movement is limited, however, to 180 deg rotation of the shaft.

Consider what happens if pressure is applied to the top of the follower when the cam is at rest anywhere between its maximum and minimum throw positions. This is explained in Fig 3 (a) and (b).

The same principle has been used in a caging mechanism for a directional gyro, recently designed at Aviation Electric. The gimbals of a gyro are normally "caged" (locked in position) when the rotor is not spinning, to prevent damage due to tumbling of the heavy rotor. We have modified this mechanism by cutting a square notch in the cam plate which coincides with the point of minimum throw. The cam follower is pressed down by the caging mechanism and forces the cam to turn (along with its shaft) until the cam follower drops into this slot. Since the shaft is attached to the lower part of the outer gimbal ring, this turns the gimbal ring along with it. When the follower drops into the slot, the gimbal ring is firmly locked in place. Fig. 1 shows the underside of the directional gyro to illustrate the practical application of the principle.

It is obvious that, if a cam-follower is held against the edge of a cam under spring pressure then we have a locating device whereby a shaft can be rotated from a position represented by the point of minimum throw of an eccentric cam. As soon as the force causing rotation is removed, the shaft will itself automatically turn back to the original reference point. This self-locating principle has been put to work in the flight computer mechanism of an automatic pilot, the Eclipse-Pioneer PB20C used in the RCAF's Argus aircraft.

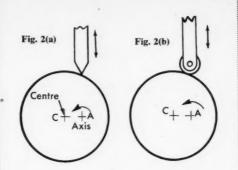
An automatic pilot needs a means of recording the deviation of an aircraft from its set course. In an electronic autopilot system, when a pilot has manually set his aircraft at the required cruising altitude and heading, he engages his autopilot. The autopilot system is arranged so that, in this condition, the electronic amplifiers are not receiving any signals from the various sensing devices attached to the aircraft controls and fuselage. In other words, everything is at null position.

Some of the sensing devices are composed of pairs of self-synchronous electric motors (or selsyns) which, when excited in pairs by the 400-cycle a-c electrical power, tend to turn themselves automatically to a null condition, represented by the position of the rotor shaft. If unable to turn, they generate a signal proportional to the amount of movement from null position. Fig. 4 shows the theoretical circuit diagram of a synchro with the self-loading cam on the rotor shaft, as well as the centring-cam mechanism.

In this mechanism, we need only record a few degrees of movement of the rotor shaft to one side or the other, and consequently the cam is just a very small sector of a larger cam. The recess into which the cam follower rides is, of course, at the point of minimum throw.

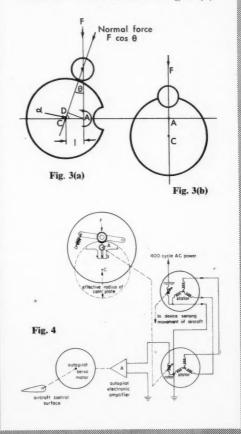
Movement of the shaft by other parts of the autopilot mechanism is brought about through an electromagnetic clutch. The force turning the shaft is naturally great enough to overcome the slight thrust of the cam follower against the surface of the cam, and consequently the synchro generates a signal which, after passing through the electronic amplifier, is interpreted by the autopilot to move the control surfaces.

Mr. Eggleton is a member of the technical publications staff of Aviation Electric Limited, Montreal, Quebec.



For any intermediate position, as in Fig. 3 (a), the force F applied to the cam follower has a component $F\cos\theta$, tending to turn the cam about the axis A. This force $F\cos\theta$ is applied on a lever arm of $l\sin\alpha$, and the torque at A is thus $F\cos\theta$ $l\sin\alpha$. Maximum torque is developed when $\alpha=90$ deg and $\sin\alpha=1$. As α becomes less than 90 deg (due to rotation of the cam) $\sin\alpha$ decreases until it is zero and the torque at A disappears.

The cam always turns towards the point of minimum throw, where a recess is located. This is shown in Fig. 3 (b).





Space saver stacking chairs designed by Orr Associates.



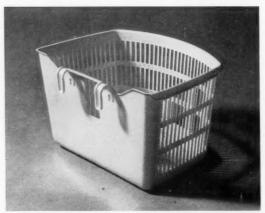
Royal portable by Laird Covey and Faber Birren.

NIDC Awards for 59

A sampling of design awards made to Canadian products rated as outstanding in design, usefulness, value



Iron frame chair, foam cushions-Metalsmiths Co. Ltd.



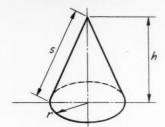
Smith and Stone bike basket of high density polyethylene



Lawrie McIntosh designed this troublelight handle; it is lightweight, impervious to most solvents, easily gripped.

Design Engineering DATA SHEET More section properties

RIGHT CIRCULAR CONE



Area of base

 $B = \pi r^2$

Circumference of base $C = 2\pi r$

Surface area

(open cone)

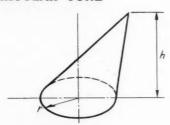
(closed cone)

 $= \frac{1}{2}sC + B$

Volume

 $V = \frac{1}{3}Bh$

ANY CIRCULAR CONE



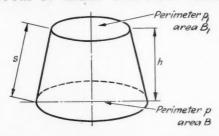
Area of base

 $B = \pi r^2$

Volume

 $I = \frac{1}{3}Bh$

FRUSTUM OF RIGHT CIRCULAR CONE



Surface area

(ends open)

 $=\frac{1}{2}s(p+p_1)$

(ends closed)

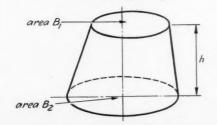
 $=\frac{1}{2}s(p+p_1)+B+B_1$

Volume

 $V = \frac{1}{3}h(B + B_1 + \sqrt{BB_1})$

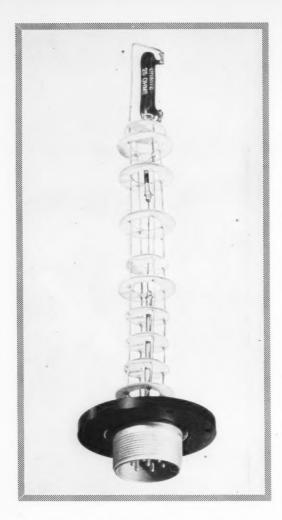
FRUSTUM OF ANY CIRCULAR CONE

(with parallel ends)



Volume

 $V = \frac{1}{3}h(B + B_1 + \sqrt{BB_1})$



What the hypsometer does

The hypsometer is an instrument for measuring pressure indirectly, by measuring the boiling temperature of a liquid in equilibrium with its vapor. Because of the strict 1:1 relationship betwen the equilibrium temperature and pressure of a vapor-liquid system, there is no practical limit to the accuracy (or speed of response) of such an instrument, other than that imposed by the nature of the temperature sensing means.

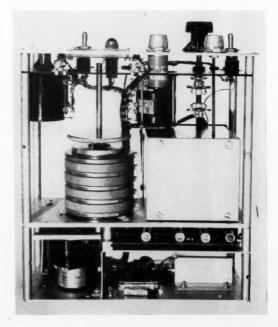
The hypsometer described here has shown itself to be superior to the aneroid as a pressure altimeter for the airborne profile recorder system, and a resolution of 1 ft is consistently maintained. The time constant of ½ sec has been found adequate and may be reduced still further by employing a very thin thermistor. Instrument errors have not been observed and they are believed to be less than errors introduced by external factors, such as pressure-height anomalies caused by weather, or local pressure disturbances associated with the aerodynamics of flying

It seems reasonable that other uses will be found for this instrument. In applications requiring a lower order of resolution (such as aircraft altimeters) a simplified and even more rugged instrument (combining precision with good sensitivity at high altitudes) could readily be devised. Other applications might be for the precision barograph and the remote-indicating barometer for survey or meteorological purposes. In the latter case, the inherent long-term stability of the hypsometer (and the ease with which it can actuate a recording pen) would be of primary interest.

The hypsometer has inherent longterm stability

This one is used as a pressure altimeter for an airborne profile recorder system

Gilbert Hobrough



Hypsometers employing the water-steam system have been used for many years, but their usefulness has in the past been limited by the precision and time constant of the thermometers used to measure the boiling point. The sensitivities are about one ft. altitude, together with a timeconstant of about ½ sec.

The equilibrium temperature of a fluid is determined solely by the pressure and the nature of the fluid. Since all fluids (and mixtures of fluids) have different temperature-pressure curves, it is important for the fluid to remain pure and uncontaminated at all times. This factor could be a major source of error and governs the choice of fluid and materials used in the construction of parts in contact with the fluid.

The equilibrium temperature of a fluid is not coincident with the boiling point of the condensation temperature, since conditions of superheating (or, supercooling) may raise the boiling point (or depress the condensation point). Equilibrium is established, however, and equilibrium temperature obtains, at an interface between the vapor and the liquid phases of the fluid, in the absence of impurities.

Fig 1 shows the elements of the hypsometer, the various zones indicated being functional only and not necessarily drawn to scale.

Fig 2 shows the actual construction of the hypsometer as presently employed in the airborne profile recorder (APR), an instrument used for measuring the ground elevation along the flight line of an aircraft, to provide vertical control for subsequent photogrammetric operations.

Foamed plastic insulation is used to reduce heat loss and to support the glass chamber, which is cemented directly to a massive aluminum condenser at the top.

An auxiliary condenser (in the form of a heavy copper wire) is connected to the thermistor by means of a stainless steel wire. Condensate from this auxiliary condenser runs down the steel wire, through the transition zone to the thermistor and keeps the surface of the thermistor wet at all times. In this way, equilibrium

temperature is maintained at the thermistor under conditions of falling pressure and temperature, which would otherwise permit the thermistor to become dry and hotter than the surrounding vapor.

The assembly of baffles, immersion heater, thermistor and auxiliary condenser is inserted in the top of the chamber. Electrical connections are provided through glass seals and a non-spill labyrinth provided to guard against accidental loss of fluid during installation.

The labyrinth is terminated by a fitting that is connected (by a flexible tube) to the aircraft static line. This leads to a pilot head, so located on the exterior of the aircraft that it senses ambient pressure, free of errors arising from the turbulent flow of air over the surface of the aircraft. The static line also leads to the altimeters and air-speed indicators.

The efficiency of the thermistor as a detector of small changes of temperature enables the hypsometer to operate at the required sensitivity of one-ft resolution. The thermistor is an electrical resistance having a very high temperature coefficient of resistance. It is composed of a ceramic-like rod of metal oxides, sintered at a very high temperature. Electrical connections are made by silver-plating the ends of the rod and soldering wires to the silver coating. The stability of the thermistor is very high.

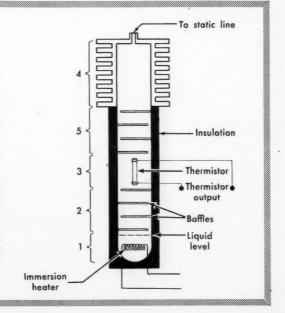
For maximum speed of response, the thermistor must be in direct contact with the working fluid and not separated by an electrically insulating layer. The working fluid must therefore be an excellent insulator at the operating temperature. This immediately rules out water, the traditional hypsometer fluid for this purpose. Toluene is used in the APR hypsometer.

Fig 3 is a photograph of the hypsometer bridge assembly used in APR 5. The bridge balance potentiometer is mounted on the same shaft as three other potentiometers. Two are used in an adding circuit to combine the hypsometer output with that of the radar altimeter to drive the profile recorder pen. *

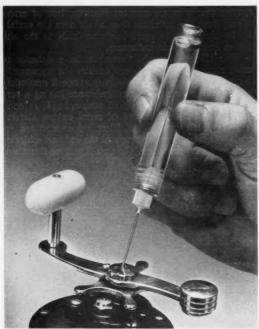
Mr. Hobrough is manager of the Research and Development Division of Hunting Associates Limited, Toronto.

Function of the various zones

- (1) **Boiling zone.** Production of vapor from the liquid phase by the application of heat.
- (2) Refluxing zone. Superheated vapors rising from the boiling zone are brought into intimate contact with condensed liquid returning to the boiling zone, in order to establish equilibrium temperature in the vapor.
- (3) Sensing zone. The temperature sensing thermistor is located in this zone.
- (4) Condenser zone. Heat is removed from the vapor in the condenser zone located at the top of the column. The vapor condenses and the liquid returns by gravity to the boiling zone.
- (5) Transition zone. Between the condenser and the sensing zone, baffles are provided to reflux the vapor with the condensate. In this way, condensate reaching the sensing zone has been re-heated to equilibrium temperature.



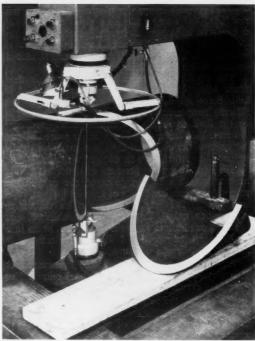
Design news in pictures



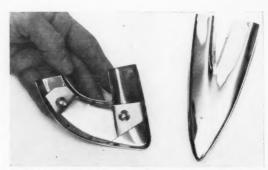
200 — Precision oiler has press-on cap and pocket clip. The stainless steel spout can reach awkward spots.



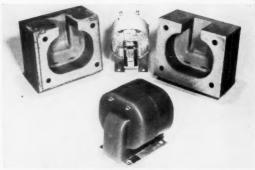
201—Designed in Canada, this fan in ventilator unit pulls in fresh air, exhausts impure air at same time.



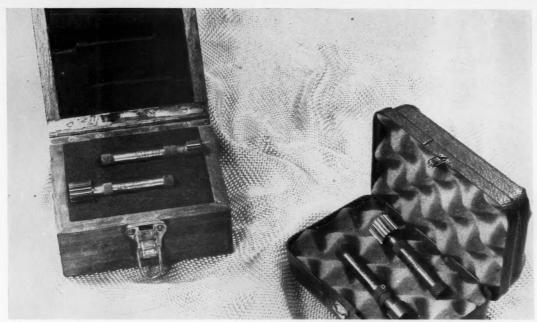
202—Accuracy of cut is said to save hours in set-up time for welding. Band machine has a full, sweep head.



203—A new method of fastening stainless steel trim to automobiles. Weld marks don't show on upper surface.



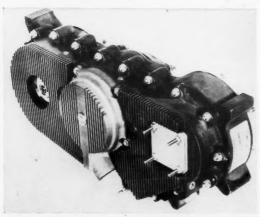
204—Use of a single component epoxy compound is shown. It resists cracking under severe thermal shocks.



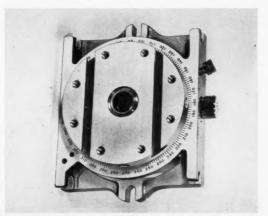
205-Material in these storage boxes protects delicate instruments, precision tools. It eliminates custom "nests."



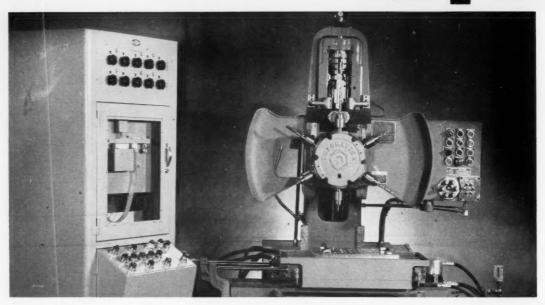
206 — Wet blasting is said to prolong die-life — save cost of other finishing operations.



207—U. S. Air Force has qualified this two-speed automatic shifting gear box for use in the T-38 jet trainer.



208—Index table is 6 in. long and provides 360 positive locking positions. It is made of light alloy castings.



Numerical control without memory store

This Canadian-designed automatic machine tool control permits high tolerances, is suitable for short runs, doesn't need a shift register

by H. G. Hauck as related to



The positioning control accepts programmed command information from standard 1 in., eight channel teletype tape. This tape may be prepared on any standard automatic punch (such as the Flexowriter and Add-punch) or an economical hand punch. The automatic punch machines produce tape in binary-coded decimal form, which is recognized by the tape reader.

The tape reader (see Fig. 5) operates pneumatically and so avoids the common problems of brush and tape wear. The air flow through the reading head also has a useful self-cleaning action.

Blocks of information are read instantaneously. There is thus no need for a complex and expensive shift register, normally required to store information registered by the sequential line-by-line readers used in conventional control systems.

A block of information consists of 2 in. of tape. This contains all command details relating to one hole position, plus any other auxiliary functions called up. The time interval between reading and machine movement is so small as to appear simultaneous.

The control system may also be supplied with manual input controls for use in instances where tape programming is considered unnecessary, such as in certain "one-off" jobs, or where a one-off modification arises at the end of a longer run. Manual input is provided in the form of a bank of decade switches for each controlled axis, which can be set to the correct command dimensions by the operator.

The Sperry automatic machine tool control is a device for positioning a table, carriage or tool post within tolerances of $\pm.0005$ in. in one or more axes. On short travels, accuracies of $\pm.00025$ in. are possible. Motions are repeated over and over again with a repeatability accuracy of $\pm.0001$ in. Drilling and straight-line milling, turning and grinding can all be controlled in sequence, by programming through a punched control tape. Positioning directly from dials (without the use of tape) is available as an accessory. The system can position machine components at rates up to 200 in. a minute in all axes.

Highly accurate linear transducers provide measurements completely independent of (and unaffected by) conventional transport mechanisms.

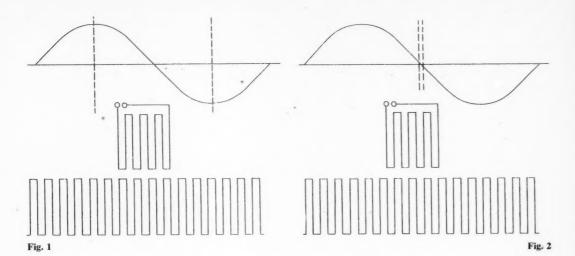
With the type of tape reader used, there is no need for a shift register or memory store and so the bulk (and cost) are greatly reduced.

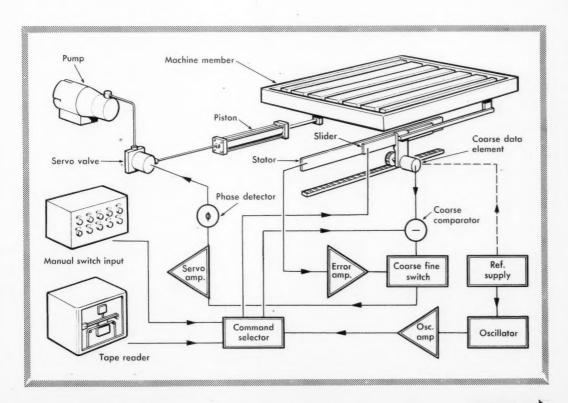
A specially designed hydraulic valve contributes greatly to the over-all positioning accuracy at high travel speeds. Other types of machine drive can, however, also be controlled precisely.

The system is most suitable for short production runs, where starting costs are usually very high. The measuring section. The heart of any precision positioning control is the measuring element. This translates linear or rotary measurements into electrical equivalents, which can be recognized by the control system. The Sperry control uses very precise linear transducers (electronic scales) (Fig. 4).

These transducers consist of slabs of a glass-mica compound, with a coefficient of expansion very close to that of steel. This compound is very tough and stands up well under industrial conditions. The slabs have plated on them a series of fine lines in the shape of an elongated hairpin coil.

The transducer consists of two major components (see Figs. 3 and 4): (1) The stator, made up of sufficient sections (aligned end-to-end) to cover the required travel length of the controlled axis. Each section is series-connected to its neighbor, thus forming one long continuous coil. All the stator sections are identical, since they are produced from the same precise master. This means that by careful initial alignment, cumulative errors can be eliminated. (2) The slider. This consists of only one section, similar to a stator section, but plated on it is a series of 25 separate coils, each coil covering about 0.25 in. The slider is rigidly linked to





the moving machine member and rides over the stator. There is a clearance of a few thousandths-of-an-inch between the two, and so there is no mechanical wear.

Low frequency ac excitation of any one coil on the slider will induce an approximately sinusoidal signal in the stator coil. This signal is at full amplitude when the turns in the energized slider coil are exactly aligned with the stator coil (Fig. 1). The signal falls off to zero when the two coils are exactly misaligned (Fig. 2).

Each coil in the slider is separated from the next by a given distance, less 0.001 in. progressively. Thus, the null points can be electrically shifted by increments of 0.001 in. by selecting appropriate slider coils.

Because each slider coil consists of several contributing turns (and the output signal at the stator is the vector sum of all turns) any local plating errors are to a large extent averaged out.

In practice, a coarse data element (geared to a small rack mounted parallel to the machine motion) is used to bring the member to within about 0.050 in. of the desired position. Pre-selection of an appropriate slider coil establishes a null at the desired final position, and the member is now driven from the end of the coarse-travel (0.050 in. away) in fine-travel to this null. Electronic switching brings the fine measuring system into play at the appropriate point. Precise positioning to 0.001 in. (with an accuracy of \pm 0.0005 and repeatability of \pm 0.0001) can be achieved with this method over all conventional travel lengths.

The transducer and coarse data element assemblies are housed in hermetically sealed units for absolute protection from chips, dust and oil.

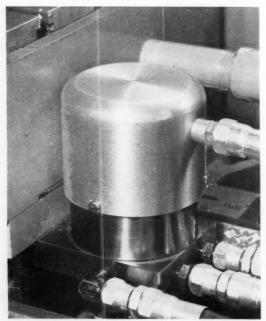


Fig 6-Electro-hydraulic valve ensures high accuracy.

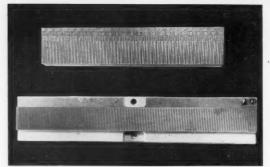


Fig 4—Precise linear transducers are used in machine.

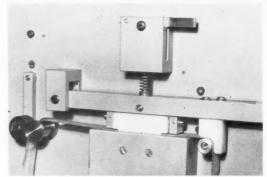


Fig 5—Less tape wear with this automatic tape reader.

The linear transducers measure accurately, no matter what the condition or type of transport mechanism. They are consequently unaffected by screw windup, backlash, high spots or dirt. They can be used to great advantage with hydraulic piston drives, without any need for linear/rotary conversion.

The power drive. The control system can operate satisfactorily with any conventional machine drive, such as ac, dc or hydraulic motors. Sperry has, however, developed (for industrial application) a new electro-hydraulic servo valve (Fig. 6) ideally suited for use with hydraulic pistons. The valve has high immunity to dirt in the hydraulic system and requires no destructive "dither" impulse for smooth and instantaneous operation. When used with pistons, the valve provides a rapid and accurate drive system, without the need for ball screws, roller ways or other technical gymnastics to overcome friction and inertia problems.

The cabinet. The main cabinet houses the tape reader and all electronic packages. It also contains the manual input switches, where these are specified.

All electronic circuitry is built up in modular plugin form. Each module consists of a printed-circuit board mounted on a supporting tray. Sub systems may be removed and replaced in minutes. A built-in test panel quickly locates faulty modules. Only ruggedized tubes are used. The cabinet itself is gasketed and pressurized to keep out dust and chips.

The author of this article is a member of the Numerical Control Dept. of Sperry Gyroscope Co. of Canada Ltd.

Ideas round-up

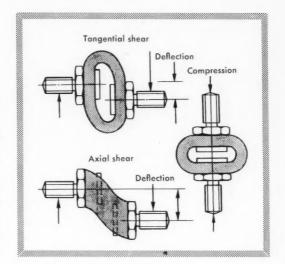
Ring mounts: suitable

for delicate equipment

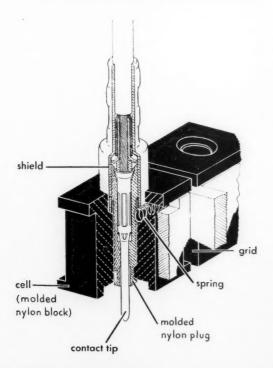
A simple and inexpensive design, the silent-bloc ring mount (Clevite Harris Products, Inc.) is a high deflection mount, well-suited for the insulation of vibration in large apparatus, or in systems involving the use of delicate equipment. It is a stud mount with the rubber mechanically secured to the metal.

Applications include: shipping mount for jet engines, voltage regulator and electronic instrument mounts. A variation of the design is the multiple-stud ring mount. This is a single, tubular rubber ring with a number of pairs of mounting studs.

A core of foam material can be inserted in the centre of the ring when it is necessary to provide additional damping and prevent bottoming. (209)



Nylon block: checks leaks in circuit

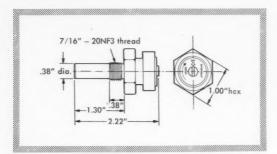


To prevent current leakage from one circuit to another, engineers of AMP Incorporated have developed a new type of cellular construction using close tolerance molded nylon "blocks." Produced by a single-cavity, automatic injection molding technique, the units meet the specifications set down by AMP's design engineers.

The new AMP programming system is constructed of molded nylon blocks alternated with interlocking metal strips. This cellular system of construction prevents current leakage from one circuit to another, while providing the strength advantages of a metal patchboard. Each nylon block has a molded-in hole, so that standard patchcords, coaxial patchcords or special shielded patchcords can be inserted. This construction permits hole layout and color coding to meet individual requirements. The excellent insulating properties of molded nylon (and its relatively high strength) give, in effect, an insulated surface. The system can be used on computers, test equipment, business machines and automated industrial processing equipment.

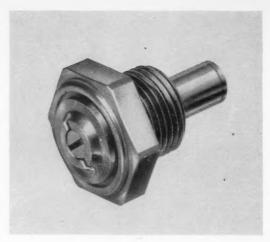
The success of the molded nylon "mating sleeve" (into which the assembled plug and lead wires are pressed) depends on nylon's property of "elastic memory." When this assembly is set into the block hole, an undercut in the sleeve engages a lip on the inside of the hole, causing them to "lock." Because of the property of elastic memory, the plug can be pulled out and reinserted without the hole losing its original dimensions and thus retaining its "locking" action. (210)

Overheat indicators: tom thumb temperature detective



Barber-Colman overheat temperature indicators provide an easy visual check by the ground mechanic after flight. The indicator readily tells when an overheat condition has occurred. Eutectic metal (located in the probe) is used to hold the indicator in place. When a condition of overheat exists, the eutectic changes from solid to liquid and releases the indicator.

An eutectic is, of course, a combination of ingredients that melt at a specific temperature. Changing the



proportion of the ingredients produces different melting temperatures. Indicators can be supplied to react at the temperature required for a particular application.

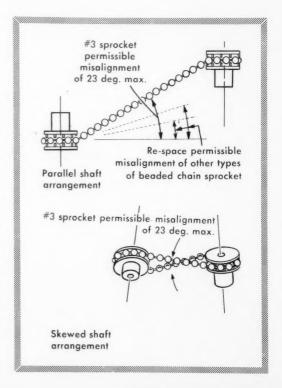
The indicator shown was designed to detect an overheat condition in engine oil on a jet bomber. Set before flight, the indicator remains closed until the engine oil temperature exceeds 275 ± 5 F. After landing the aircraft, a quick look at the indicator shows whether the engine has overheated in flight. (211)

Chain sprockets: die-cast for a beaded chain

A method used by Gries Reproducer Corporation makes it possible to die-cast a sprocket for use with beaded chain. Better traction, and greater latitude in misalignment, will make it easy for designers to use the sprocket for beaded chain drives in television, radio and other electronic controls, toys, displays, computers and similar applications. Further, the new die-cast sprocket is cheaper.

Sprockets for beaded chain drives were originally made by machining. Early attempts to reduce the cost of these intricate parts by die-casting were only partially successful, because major revisions of the original design were necessary to make die-casting economical. Consequently, these die cast designs did not match the performance of machined sprockets, which still have the largest share of the market.

An ingenious method of production has enabled Gries engineers to die-cast the sprocket basically in its original form. A #3 sprocket with 12 sockets and an OD of 7/16 in. is now in full production as the forerunner of a line of similar parts in common sizes. Not only does the new sprocket have better traction than any previous design tested, it will operate satisfactorily at misalignments up to 23 deg, a value exceeding the limit for other sprockets. (212)



Torque meter: information at once

The Found Brothers Aviation Ltd. torque meter is designed to read directly the torque (in-oz.) required to start a load or the torque required to maintain a given rotational speed.

It will permit designers and quality control personnel to determine quickly the starting friction, stiction and inertia to be overcome on a device, as well as gear train concentricities and dynamic characteristics.

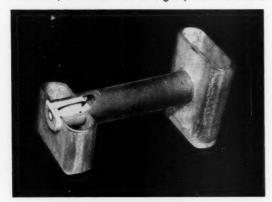
Typical torque requirements may be measured in increments of .25 in, oz. from .5 to 12 in, oz. for the Model HC 100 unit with accuracies of \pm 3% (inde-



pendent of speed) up to 10,000 rpm. Other models are available, such as the HC 400, rated from .5 to 32 in. oz. at 5,000 rpm. (213)

Fiberglas ladder: all-round safety aloft

A fire-resistant and almost indestructible reinforcedplastic safety ladder is now available from American Allsafe Co., Inc. Constructed entirely of Hetron polyester resin, reinforced with fibre glass, the latter uses a



special method of locking the rungs, to stop them from loosening or pulling away from the side-rails. No materials that conduct electricity are used in the ladder.

Every known safety feature has been incorporated in this new product. The sturdy rungs are rough-surfaced to prevent slipping, while the side-rails are designed for easy gripping, and remain smooth and nonsplintering. Requiring no preservative treatment, the plastic ladder is impervious to exposure, rot and corrosion, does not warp, split or absorb water, and under normal conditions should last indefinitely, even when stored outdoors.

The hollow tubular construction of both siderails and rungs (with Hetron-fibre glass compression-molded plugs at the extremities) keeps down the weight, but gives maximum strength without any interior reinforcing. Offered in both single and extension types, the ladder considerably exceeds American Standards Association code No. A 14.2 for strength, yet it weighs no more than a good quality, all-purpose wooden ladder. (214)

Nonmetallic laminate: a growing family

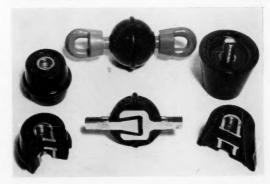
A nonmetallic, resin-bonded laminate, known as Tufnol, is a versatile material, used extensively in industry throughout the world, for such components as gear wheels, rolling mill bearings, rudder and stern-tube bearings, rail track insulators, aircraft components, motor parts, jigs, coil formers and punchings.

The material stands rough use, is strong but light, will not readily chip or splinter and resists corrosion.

It is available in sheets, tubes, rods or shapes specially made to order. Tufnol is manufactured in several brands, all of which can be machined with the usual engineering tools.

Its excellent electrical insulation properties make the material ideal for a wide range of components in the electrical industry. Indeed, it was as an electrical insulator that Tufnol was first introduced. Panels for instruments, switchboards and starters, insulated nuts, bolts, screws and bushings, bobbins and formers for coil windings, brush bars and brush bar holders, moulded

insulators, rail track insulations, terminal boards, busbar supports and chambers and slip-ring housings, are some of the many components for which Tufnol is now an accepted material. (215)

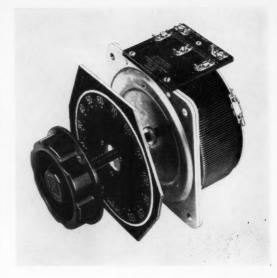


Autotransformer: with wrought metallic parts

Claimed to be more rugged, more adaptable, and more durable than its predecessors: the General Radio Type W20 Variac Autotransformer, the latest model in the redesigned W series. These designs are the result of careful planning aimed at supplying the best possible, continuously-adjustable autotransformer.

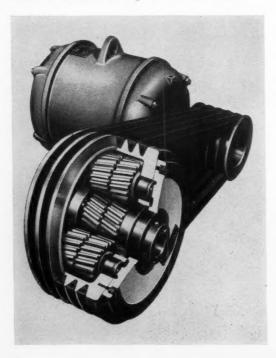
Wrought metallic parts have been substituted for castings in the interest of improved mechanical properties. Heat transfer between coil and base, brush and radiator has been improved. Ball-bearing models for motor-drive and other demanding applications are stock items. All have Duratrak contact surfaces, to minimize brush-track deterioration and give a long and trouble-free life.

Basic uncased models are available for 115 and 230 volt service, rated at a maximum of 3.0 and 2.4 kva respectively. Cased models have knockouts for conduit or armored cables. The case front is easily removed for access to the terminals, mounting holes and brush. Ample space is available inside the case for wiring. Two portable models include a 3-wire attached cord and plug, output receptacle, switch and overload circuit breaker.



Speed reduction: gear box in a pulley

The Furnival speed reduction pulley was designed for applications demanding a sturdy and compact speed-reducer for direct mounting on the driven shaft.



The most revolutionary feature of the unit is the method of keying the planet pinions to their respective shafts. This method was devised mainly to overcome the difficulties in equilibrating the load when more than one multiple gear train is fitted round the central sun gears.

If one set of planet pinions transmits a given force, then N planet pinions will transmit N times that amount. This is only the case, however, if the gear teeth bear upon each other simultaneously. Using the conventional method of steel keys and keyways, one set of planet pinions can be easily fitted, but the assembly of the second set requires very accurate setting of the keyway position.

It is well known that the accurate location of the pinions is made more difficult when they are hardened and ground. As more planet trains are incorporated, it becomes impossible to obtain equal loading on all the gears.

In the method used for the pulley, the reduction unit is permanently assembled. The pinions are mounted on their shafts and left free to rotate, so that they can take up their natural position. Special adapters are used in the position of the planet shaft bearings, to enable the planet gears to be preloaded and set in their correct position relative to the central sun gears. This assembly now forms a mould which is preheated. Liquid nylon is then injected by a specially-designed injection press. The adapters are then removed and the correct bearings inserted.

Slight elasticity in the nylon allows the bearings to give the pinions sufficient working clearance and thus equilibrates the load upon them. (217)

Keeping

New booklets and technical data for you to read

Stainless Steel Select-O-Chart — Remember the Alloy Metal Sales chart for aluminum and magnesium? Another, very well thought out slide chart for stainless steel has been produced. Company will send you free copy.

Lubrication — just off the press is a lubricant manual for instrument ball bearings. It is said to be the first of its kind in the miniature bearings industry. Published by Miniature Precision Bearings Inc.

Grain size of brass alloys — among other things, this bulletin explains how the grain size of brass strip is affected by annealing and cold rolling. Bridgeport Brass Co. publish it.

Universal joints — 10 pages of useful information and specifications including applicable military specifications. Curtis Universal Joint Co. Inc.

Variable transformers — Bulletin 151 expounds on "no-overvoltage" transformers and also delves into operating data and dimensions on tandem assemblies. Ohmite Co.

Shear fasteners — charts and drawings in two new bulletins tell about new series of fasteners for applications to 900 deg F. Standard Pressed Steel Co.

Press news — men concerned with new press design will probably be interested in bulletin SD-1 (Blow Press) describing a new line of straightside, double crank, power presses.

Clutches and brakes — three generously illustrated and well-produced brochures describe the Fawick Corporation's varied applications of industrial clutches.

Gold formed angles — not about the Soviet — but a most useful, compact reference in booklet form describing angles, sizes, design data related to steel structures. Algoma Steel Co.

Selecting a strain gauge — reprint of an article appearing in Strain Gauge Readings. This is specialist reading information. Stein Engineering Services.

Check Valve — beautifully compiled information is slanted toward a tilting disc check valve. Lots of engineering and application data. Dominion Engineering publish the bulletin.

Nickel Bulletin — this is from the U K—and is a 34-page book devoted to the summary of recent alloy literature. Mond Nickel Co.

Digital Recording systems — a four-page leaflet on building block elements and basic systems. Datex Corporation.

Skylights — aluminum and fibreglass skylights are discussed in this brochure. Pre-assembled units are stressed. Marco Company Limited.

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with DUAL-RANGE capacity!



- Up to .500 mild steel, using removable Strippit mechanical springs
- Up to .750 mild steel, with interchangeable Strippit Hydra-Springs
- Convertible from .500 to .750 capacity in seconds, at minimum cost
- One heavy-duty holder for both capacity ranges
- Readily replaceable punch tips and dies—round, obround, square, shaped
- Keyed punch body keeps punches accurately aligned

USING STRIPPIT MECHANICAL SPRINGS

Max. punch dia.	Max. material thickness (mild steel)
1.375	.250
1.250	.375
1.125	.500

USING STRIPPIT HYDRA-SPRINGS

Max. punch dia.	Max. material thickness (mild steel)
1.375	.375
1.250	.500
1.125	.625
1.000	.750



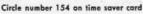
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WRITE TODAY for the new Strippit General Catalog. It covers all details on this and all other Strippit units... plus the savings in tooling and press time effected with the famous costcutting Strippit System of fabrication.

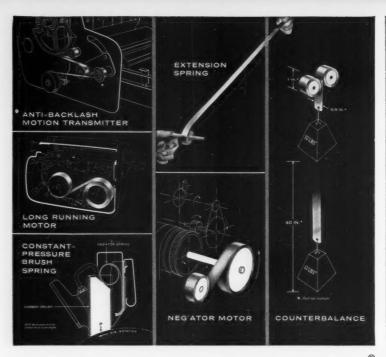


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Briefs

We note with interest . . .

that corrosion or rust may soon be history. An answer has been found to the age-old question of how to prevent this type of metal deterioration-and it is contained in peat and other vegetable matter . . . a firm of Montreal contractors was fined recently by a judge of the Superior Court for illegally using the title "engineer" in its company advertising (see DE's editorial for Feb., '59) . . . blow, blow thou winter wind-but a lot of construction firms won't mind this any more. A new Canadiandeveloped cement curing unit promises to cure cement in winter in half the time of conventional methods, and Scroogishly saves money too . . . if you follow company mergers here's one for your books: Shawinigan Chemicals Ltd. becomes sole owner of Canadian Chemicals and Resins Ltd through acquisition of Union Carbide Canada Ltd's 51 per cent interest in that company . . . a few weeks ago Toronto Metro roads committee was disturbed to learn that no way had been provided for motorists to reach Bloor St. from the nearly \$3 million Bayview Ave. extension. This would be a good spot for an auto body repair shop don't you think? . . . guess where a new series of nonmagnetic foils (up to 250-millionths of an in. thin) have a major application. Why in hi-fi recording heads of course-no decadent equipment for the galaxy of caterwauling "stars" of the recording world . . . If you've been thinking about going to the Royal Agricultural Show in Oxford, England, this July 7-10, the show people are well-disposed to Canadian visitors will give you a free admission . . don't ever worry, gents, about what's being done to evaluate the dynamic performance of man's fastest earthbound test devices. Some back-room boys have been burning the midnight oil on methods and idioms-two of which are the spacetime quantizer and the "light foot". the firm introducing a cold phosphating system (low temperature way of preparing steel for painting) say they got off to a very slow start, but in last year 100 plants have adopted the method ... use of aluminum in North American autos has doubled since 1955-now it's a per car average of 57 lb . . . we are glad to see that at least one paint company is giving some concentrated thought to pleasure boat finishes . . . laminated plastics are in the news again with the announcement that Cyanamid of Canada Ltd. will spend more than \$11/2 million in converting its plant facilities at St.

Jean, Que., for the production of Formica . . . stop-press news for henpecked engineers comes in the announcement that a new breed of onion is in the offing. It's odorless. What's the odds some enterprising firm starts to bottle "onion smells" for the acutely nostalgic . . . an acrylic-type thermoplastic polymer possessing both high heat resistance and stiffness and toughness has been developed. We understand it has heat distortion point of 240 deg F . . . Dates for your deskpad: May 17-20 in Montreal-National Industrial Service Association convention May 19-21 in Baltimore, Md. -American Institute of Electrical Engineers (125 papers will be presented) June 22-26 at MIT-National Association of Corrosion Engineers short course in fundamentals June 22-24 at University of Buffalo, N.Y.-Fifth Annual Creative Problem-Solving Institute June 29 in Toronto-Joint Engineers & Scientists luncheon at Royal York. HRH Prince Philip speaker and guest of honor October 7-9 in Philadelphia, Pa,-Sixth Symposium on Vacuum Technology by American Vacuum Society . . . drew some stony glares from fellow straphangers on the subway one day last week when we broke out in loud guffaws. We'd just remembered the news release that informed us about a "cat whisker soldering machine" . . . neoprene-covered wire and cable is apparently being used increasingly we hear. Some rollers of printing presses are made of it too . . . the 41st Annual Meeting of the American Zinc Institute held in Chicago April 23-24 announced details of its international research program . . . following hard on its heels is a bulletin published by the American Society for Testing Materials; it tells all about its work in meeting the challenge of the Space Age . . . congratulations to the agricultural engineering department of the University of Saskatchewan for developing a machine that incorporates seed-cleaning features. We understand this is a major step forward in reducing weed infestations . . . we are certainly not sleep-olics but another two slumber items have turned up on our desk (see Feb. Brief Talepiece). Dr. Boris Vasileff of Genoa agrees that snores hit their peak when supine-his "psicofon" picks up the snore, amplifies it and blasts it back in the snorer's ear. The noise disturbs Old Flutternose himself who turns over on his side-thus enabling everyone within earshot to heave a sigh of sleep. An English chap has just invented a bed that has everything, meaning tv, thermostat-controlled mattresses, mink covers, radio, telephone, tape-recorder, electric shaver and teapot, vibro-massage, master control panel that eavesdrops on every room in the house. But even this four-poster Cadillac (sorry, Rolls Royce) can go wrong. We can just imagine the nightmare of being

shaved involuntarily, scalded with hot tea and folded up in the mattress while our screams are recorded on tape for posterity . . . a lot of emphasis these days is being put on the lasting qualities of metals. Bearing us out is news from the Brass and Bronze Institute that hundreds of new industrial and consumer uses for bronze castings will lead to stronger and longer-lasting products . . . this sounds interesting-nylon-insulated solderless connectors for pigtail splicing of two or more wires is now available . . . other current information is that automatic switches that transfer service for power and light to an emergency source in the event of normal voltage failure will now be made and marketed in Canada . . . another date for you—May 14-16 at the Chateau Laurier, Ottawa, Acoustical Society of America meeting . . .

Brief Talepiece — "Foorskoor and sevn yrz agoo aawr faadhurz brot foorth on dhis kontinent ei niww neishun, kunsyvd in liburti, and dedikeited tw dhu propuzishun dhat dhat ol men aar ykwul." In case you're not sure, this is the first sentence of Lincoln's Gettysburg address. It is written using the phonetic alphabet originated by Kyril Evans, an electrical engineer of Hamilton, Ont. Mr. Evans has devoted many years to the study of phonetics—published his findings in book form. Dhat iz ol for naaw. ★

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Circle number 144 on time saver card

New products & materials

Transistorized digital clocks

Totally transistorized, digital clocks for time duration and time internal measurements are now available from Electro Instruments Inc.

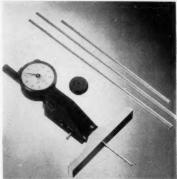


They feature both a direct read-out, illuminated display and heavy-duty output closures for data recorder entry, such as printers, electric typewriters, card punches, etc.

Time measurement is based on 60cycle line frequency; however, provision is made to slave the clock to an external frequency source or time base. Clocks can be provided for operation on any frequency from 25 to 128 cps.

Double-acting depth gauge

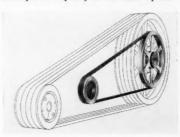
The accurate determination of the location of either internal or external grooves is said to be simplified by the new Mueller Depth Gauge.



A precise Ames dial indicator accurately measures the travel of the footed rod and direct measurements may be obtained for both the location and width of groove in one operation. A release pin located on the side of the gauge body permits measuring in either direction from the measuring anvil. The J. B. Morrison Machinery Co. Ltd.

V-belt drive design

After more than five years' work in its research laboratories, Gates Rubber of Canada Ltd. has placed on the market, its Super HC V-Belt Drive. With narrower, deeper cross-sectioned, high-capacity belts and new narrower sheaves, it is said to present a new concept in power transmission, packing up to three times the horsepower capacity in the same space.



The company says the new drive permits four reductions - in the width of belts and sheaves; in the diameter of sheaves; in centre distances; and in the over-all cost of drives. The savings that can be effected are estimated to run as (220)much as 20%.

Needle valve

A high pressure needle valve designed for pneumatic and hydraulic systems utilizes a renewable glass-filled teflon seat to assure a bubble tight shut-off with hard to hold fluids from vacuum to 6,000 psi. This valve is constructed of AISI 303 stainless steel with teflon "O." Dragon Valve Co.

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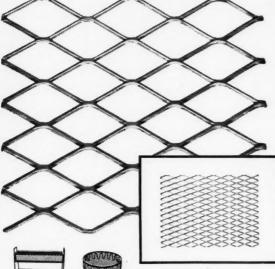
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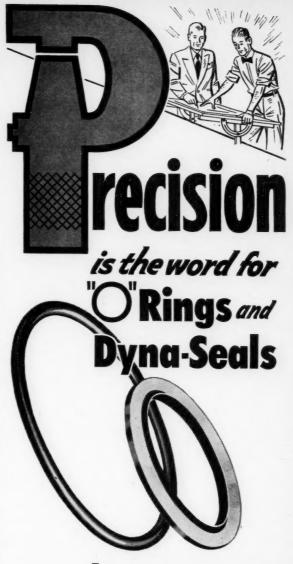
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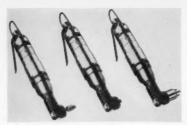
recision Rubber Products (CANADA) LTD.

"O" Ring and Dyna-seal Specialists Toronto, Ontario. - Ste. Therese de Blainville, Quebec.

Circle number 141 on time saver card

New products (Continued from page 76)

A new series of Kellar air tools, designed for drilling or assembly operations in close quarters, has been announced by Gardner-Denver Company. The angle drills, nut setters and screw drivers are tailored for minimum clearance applications in the assembly of appliances and small durable goods and components of larger consumer and durable goods, defense equipment and industrial machin-

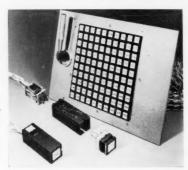


ery. Ranging in weight from 21/4 to 33/8 lb the tools feature ball bearings, bevel gears and splined drives.

Each tool is available in five sizes with speeds ranging from 3,200 rpm for (222)smallest sizes to 450 rpm.

New lighted pushbutton

Designated the C-20 Series a new group of lighted pushbutton switches is being introduced by Electrosnap Corporation. This new design is said to increase the versatility of lighted switches. The two bulbs can be of different colors, and can each indicate two functions by using

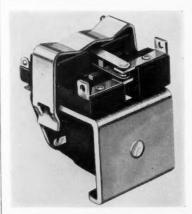


steady or flashing light. Design with two bulbs and button baffle permits monitoring of up to six conditions: using steady and flashing color on left half of button, different color steady or flashing on right half of button, and simultaneous steady

or flashing color on both halves. (223)

General purpose relay

Known as Type FC, this two-pole relay has silver contacts riveted to a molded panel. It is rated at 2 amperes resistive at 26.5 volts dc or 115 volts ac. Unit is designed for commercial applications where low cost and maximum performance are important.



A single-pole, single-throw relay, the Type FC can operate as low as 200 milliwatts. As a double-pole, singlethrow relay it can operate up to 2 watts. Coils are available for operation up to 115 volts dc.-Allied Control Co. (224)

Weather-proof plugs

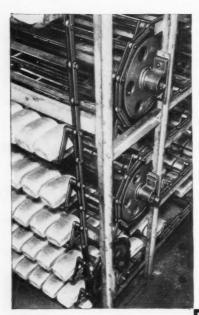
All-weather connectors capable of withstanding extreme conditions of mud, ice and water, have been developed by Cannon Electric (Canada) Ltd.

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CAN YOU HELP US?

Design Engineering's July issue will be devoted to Research and Development in Canada.

Have you information available about your company's R & D. If so — please write for a questionnaire to:

The Editors,

Design Engineering, 481 University Ave., Toronto



Circle number 153 on time saver card

LOCTITE secures 98 studs against vibration



Locking studs with Loctite Liquid Sealant in transmission unit of jet aircraft starter.

Cast aluminum gear cases for jet aircraft starters are machined and assembled at The Black Rock Manufacturing Company, successor to Reed-Prentice Corp., Bridgeport, Connecticut. The 98 studs used in the unit are treated with LOCTITE Sealant to secure them against vibration. The jet starter units receive an input of 2500 rpm and develop output of 5000 rpm to each of three flexible shaft connections. Loc-TITE was selected for this application since it provides a greater prevailing torque than any mechanical locking device. The locking strength of LOCTITE is not affected by the wide temperature ranges the unit encounters in arctic to tropic operation.



Stud thread is handdipped in shallow tray of Loctite, then positioned in casting for tightening. Three sizes of steel studs are used: ¼"-20, ½"-18 and ½"-16.

Two ½"-14 thread inserts are treated with Loctite to lock and seal in casting. The inserts provide non-abrading threads for removable oil-drain plug.



LOCTITE Sealant is a thin liquid that hardens into a tough heat and oil-resistant plastic bond when confined between closely fitting metal parts. No amount of vibration will shake loose a LOCTITE treated threaded fastener, yet

ordinary tools may be used to remove the part. LOCTITE is used to hold bearings, bushings, or hardened sleeves to shafts without press fit; seals joints against high pressure fluids. Write for literature and free sample.



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See LOCTITE in action — Booth F19 National Industrial Production Show Toronto — May 4 Through 8

Circle number 101 on time saver card

People in the news

Born in Leamington, Ont., and a chemical engineering graduate of Queen's University, Ronald Tillotson has been appointed engineering sales manager of Husky Manufacturing and Tools Works Ltd., Toronto. He was formerly with the plastics division of Du Pont of Canada and the Polymer Corporation.





Rilodeau

Formerly Canadian sales manager for the Industrial Division of Honeywell Controls Ltd., R. J. (Rod) Bilodeau has assumed the position of general manager, Industrial Equipment Division for continental Europe. Mr. Bilodeau is a graduate in mechanical engineering of McGill University.

The formation of a new Speer Carbon subsidiary — Speer Carbon Co. of Canada — is announced. With it comes news that **R. W. Spafford** has been appointed general manager. He is a Toronto University graduate in electrical engineering and has 11 years' experience in the carbon and graphite industry. The new company will be located in Ville St. Laurent.





Cai

New manager of Customs Products Division of Frigidaire Canada Ltd. is Mr. J. H. Cairns. A graduate of the University of Toronto mechanical engineering class of 1933, he has had 26 years' experience in engineering — five of them with the RCE. Mr. Cairns is a past chairman of the Ontario Section, American Society of Refrigerating Engineers.

Les Jackson has been appointed assistant general manager of Canadian Line Materials Ltd., Toronto. His experience includes work with Bepco Canada and CGE. Prior to his new appointment he was eastern district sales manager for Federal Pacific Electric. Mr. Jackson is a registered professional engineer.

Wilfred C. Frederiksen has been appointed sales manager of the industrial products division of Alpha Manufacturing Co. Ltd., Winnipeg. Mr. Frederiksen has been chief engineer in the Winnipeg plant for the past four years. He is a graduate of McGill University. Purchasing agent since 1946, Stan A. Lillies becomes sales manager, commercial products.

We hear that **John Cowlin**, design engineer for Saanich municipality (B. C.), has planned a new type of street lighting for his community.

A group of young Canadian and British engineers who lost their jobs with the closing of the A.V. Roe Arrow project, have formed their own company — New Ventures Ltd. President is Robert Mason. The firm's first contract was signed April 6 with Massey-Ferguson Ltd., to undertake tool designing.





a Dy

The firm of Haddin, Davis and Brown (Saskatchewan) Ltd., consulting engineers, have appointed Mr. H. Soloninka as manager.. He is a graduate of Queen's University and has worked as a consulting engineer in power, industrial, and municipal projects in Canada and Pakistan.

A new mechanical contracting firm has been founded — R. H. Dyson Company Ltd. — with head office in Toronto and branch offices in London, Ont., and Winnipeg. R. H. Dyson is president—he was previously v-p of Canadian Ice Machinery Co. Ltd.

Appointed lighting specialist of Canadian Line Materials Ltd. is **Charles Albini**. Born in Calcutta, India, and educated in England, Mr. Albini brings a wealth of experience to his new post. He is a member of British and American Illuminating Engineering Societities.

Formerly v-p of Lyman Tube and Bearing Ltd., James C. Leahey has been appointed general manager of British Timken (Canada) Ltd. Mr. Leahey is a graduate of McGill University, a professional engineer of Ontario and a member of the Engineering Institute of Canada.

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Why not look into the advantages of using malleable iron for parts where the going is tough? We at Galt Malleable Iron Company welcome the opportunity to discuss the applications of malleable iron with you. Just drop us a line. SEE WHAT MALLEABLE IRON WILL DO FOR YOU.



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Circle number 142 on time saver card

New products (Continued from page 78)

Power relay

A 25-amp heavy-duty power relay (made by Guardian Electric Mfg. Co.) is said to have electrical characteristics equivalent to or even greater than those of bulkier devices. Contact arrangement of this 2210-U Relay is two-pole, single



throw, normally open and has an "interchangeable coil" feature. The coil assembly can be removed and replaced in a few minutes. Contact assemblies can also be rapidly replaced, if necessary, by simply removing terminal screws. (226)

Hollow shaft differential

Designed to permit interchanging of end gears are two models of 1/8-in. hollow shaft mechanical differentials.

Greater flexibility for original design work is claimed. One model has an .880 diameter working circle and .500 across the inside face of end gears the other 1/8-in, model has a working



circle of 1.032 diameter and .563 across inside face of end gear. Both models can be modified in backlash and breakaway torque to meet departures from standard performance.

The above units are available in either a 1/8-in. or 3/16-in. bore. All hollow shaft models can also be furnished with shafts preassembled. Arch Instrument Co. are makers.

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Hi-Duty makes leakproof connections for Panellit Control Boards

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requirements for control boards. That's why Panellit selected Hi-Duty.

Just push tube into fitting and tighten nut to make a Hi-Duty connection. One man can assemble unter 4 Hi-Duty 6ttings.

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SAVE 36% TO 72% JOB TIME Type of Average Time For Each Joint Per Hour ble up to 4 Hi-Duty fittings in the time it takes to as-semble one flare fitting. Can be disconnected and reconnected repeatedly

Fast connections and leak- without leakage...take 5 proof performance are top times the vibration of compression or flare fittings.

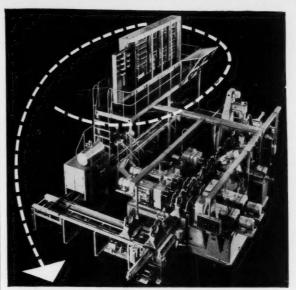
Type of Fitting	Average Time For Each Joint	Joints Per Hour
HI-DUTY	11.7 sec.	307
Regular compression	18.5 sec.	194
Flare	48.2 sec.	74

These studies made under actual shop condition

THE IMPERIAL BRASS MFG. CO. Dept. DE-59 18 Hook Ave., Toronto, Ont.



Circle number 130 on time saver card



A complex control panel supplied by Hammond for this automation equipment built by Standard Modern Tools Ltd.

. at the design stage on **ELECTRONIC-ELECTRICAL** CABINETRY and METAL WORK



A Hammond built control console in use at Atomic Energy of Canada, Chalk River.

Hammond is equipped to produce intricate cabinetry and metal work related to the nucleonic, electronic and electrical industry.

The factory will be pleased to discuss your requirements on production runs, production prototypes or single units, and suggests that enquiries should originate at design level wherever possible.

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faults of conventional two-piece
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Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd Street, Edmonton, Alberta, Canada

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Advertising Index - May

	march moning mack may	
Key 101 102 103	No. Page N American Sealants Co. Anaconda American Brass Ltd. Atlas Steels Ltd.	80 31 10
104 105 106 107 108	Bakelite Co. Div. of Union Carbide Canada Ltd. BMB (Sales) Ltd. Bristol Co. of Canada Ltd., The Brown Canada Ltd., David Bruning Co. (Canada) Ltd., Charles	29 85 84 12 9
109 110 111 112 113 114 115	Canada Iron Foundries Ltd. Canadian International Paper Co. Canadian Kodak Co. Ltd. Canadian Johns-Manville Co. Ltd. Chesterfield Tube Co. Ltd., The Clearprint Paper Co. Crofts Canada Ltd.	16 42
116 117 118	Dominion Fasteners Ltd. Dominion Forge Ltd. Dominion Rubber Co. Ltd. — Naugatuck Chemicals Div.	35 32 41
119 120	Eagle Pencil Co. of Canada Ltd	37 83
121	Flexonics Corp. of Canada Ltd	81
122 123 124 125	Galt Malleable Iron Ltd. General Tire & Rubber Co. of Canada Ltd. Glidden Co. Ltd., The Greening Wire Co., The B.	81 81 15 36
126 127 128 129	Hammond Mfg. Co. Ltd. Heim Co. Holman Bros. (Canada) Ltd. Hunter Spring Co.	83 38 18 74
130 131	Imperial Brass Mfg. Co	83 82
132	Link Belt Ltd,	11
133 134 135 136	Marsh Instrument Co. Miniature Precision Bearings Inc. Mobay Chemical Co. Morse Chain of Canada Ltd.	84 7 39 19
137	Noranda Copper & Brass Ltd	40
138 139 140 141 142	Pedlar People Ltd., The Polymer Corp. Ltd. Potter & Brumfield Canada Ltd. Precision Rubber Products (Canada) Ltd. Protective Plastics Ltd.	77 4 2 77 82
143 144 145	Renold Chains Canada Ltd. R & M Bearings Canada Ltd. Rohm & Haas Co. of Canada Ltd.	78 75 17
146 147 148 149 150 164 151 152 153	Skinner Electric Valve Division 1 E Spaulding Fibre of Canada Ltd. Standard Tube & T. I. Ltd. Steel Co. of Canada Ltd., The Steel Co. of Canada Ltd., The Stevenson & Co. Ltd., James W. Stone Franklin of Canada Ltd. Stratoflex of Canada Inc.	21 3.C. 13 25 30 44 84 76 79 73
155 156		3.C. 28
104 158 159	United Shoe Machinery Co. of Canada Ltd	29 23 26
160 161 165	Victor Mfg. & Gasket Co. of Canada Ltd	22 81 85
162 163		20 79

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VICTOCOR is the newest heavy-duty gasketing material, especially for high flange pressures. Steel core construction speeds heat transfer, increases strength, yet is highly flexible.

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Editorial

Come on! Make an effort this year

Once again the Design Engineering Show and Conference is nearly upon us, this year to be held on May 25-28 at Convention Hall, Philadelphia.

Details are given elsewhere in this issue and it is hoped that the attendance of Canadians will be greater than in other years. Probably it will, because of the booth that the Canadian Government has taken there to highlight Canadian designs for export.

It is claimed that 400 companies will exhibit some 12,000 products to an expected 18,000 viewers.

To be seen will be metal alloys, plastics, synthetic rubber, power transmission equipment, electrical and electronic components, mechanical components, various shapes and forms (yes, they will be there again!), fasteners and adhesives, finishes and coatings, hydraulic and pneumatic components. Practically everything, in fact, that the design engineer wants to see.

Without fee

In future, no registration fee will be necessary when the members of 21 sister engineering societies attend general meetings of the ASME.

This is to encourage greater liaison between engineers, for many ASME national meetings are of vital interest to the members of these related societies.

Gray iron castings

Closing date for the annual Design Contest (sponsored by the Gray Iron Founders' Society, Inc.) is June 30. This competition gives recognition to designers and engineers, the entries being judged on: how the design (or re-design) increases the product efficiency; how it cuts costs; its commercial importance; its ingenuity. Why not send in your entry now.

William Morse.

Instead of writing to a dozen different manufacturers to get information and literature about products mentioned in DESIGN ENGINEERING just circle the numbers on the other side of the card below . . . complete and mail . . . We contact the manufacturers for you and pay all postage.

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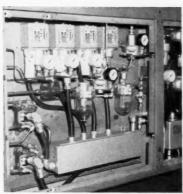
Editorial Please send me further information on the following editorial items:

MAY 1959

Skinner solenoid valves solve many different cylinder control problems



Application. This Bryant "Centalign" automatic internal grinder is an entirely new concept in precison grinding machinery. Work parts are gravity-fed through chutes and loaded to grind position automatically. Centalign design permits higher, more accurate production at lower cost in the grinding of straight or tapered bores or forms such as ball tracks.



Seven Skinner valves used. Fourway, V9 valves control cylinders actuating work ejector, work interceptor and work loading chute. Others control cylinders for activating a diamond holder for wheel sizing; an oscillator for grinding; and a compensating cylinder to skip wheel dressing action. Still another controls the shop-air supply to the machine.



Adjustable flow features of the four-way valves permit split-second adjustment of cylinder action. And all the valves are small, compact and easy to mount at any angle. Built-in spring returns assure positive closing. Such features enable Bryant to manufacture the Centalign in panels that afford easy access to all pneumatic, hydraulic and electric circuits.



A complete line. There's a Skinner solenoid valve for almost any flow application with a wide variety of media: air, oil, water, inert gases, hydraulic fluids, kerosene and gasoline. Orifice sizes range from 3/6," to 1". Pressure ratings range from 5 psi to 3000 psi. Explosion-proof models are UL approved for Class 1, Group D and Class 2, Groups F and G.



100,000 variations. The Skinner valves used by Bryant are so versatile in design that standard models can be used for applications normally calling for specials. Skinner solenoid valves are engineered to have a life expectancy of millions of trouble-free cycles.



Quality assured. Electrical tests to UL Standards include resistance check of coils in valve; breakdown check of 2x's rated voltage plus 1,000 volts; heat rise check of continuously energized coil for operation not above 85°C (185°F) rise above room temperature. These tests assure that you can use Skinner solenoid valves with confidence.

Skinner has a wide selection of solenoid valves for all types of applications. If you have a control problem, please contact the following Skinner distributors or write us at the address below, Dept. 351.

Cowper Co., Ltd. Dycon Limited C. M. Lovsted & Co., Ltd. Petro-Automation Industries

Cowper Co., Ltd. 515 Fourth Avenue, Lachine Montreal, Quebec

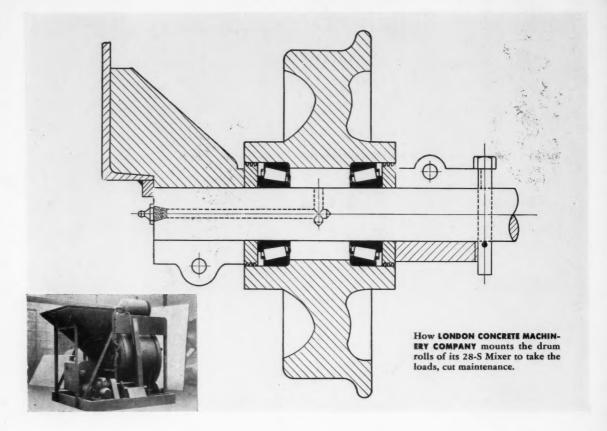
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VALVES

THE CREST OF QUALITY THE SKINNER ELECTRIC VALVE DIVISION . NEW BRITAIN, CONNECTICUT

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Monster mixer stays on the job as TIMKEN bearings take monster loads

WHEN London Concrete Machinery Co., London, Ont., built this monster 28-S Mixer, they designed four drum rolls to take the tremendous loads encountered in mixing tons of concrete. To make doubly sure there would be no load problems, they mounted each drum roll on two Timken tapered roller bearings (see diagram above). Here's why:

- 1. Full-line contact between rollers and races gives Timken bearings extra load-carrying capacity to stay on the job day after day, year after year.
- 2. Their tapered construction lets

Timken bearings take radial and thrust loads in any combination. They roll the load, keep machines working with minimum maintenance.

3. Shock loads are no problem because Timken bearings are case-carburized—have hard, wear-resistant surfaces and tough, shock-resistant cores on both rollers and races.

That's why Timken bearings prevent breakdowns—why they cut maintenance costs to a minimum. And closures are more effective because Timken bearings hold shafts concentric with housings. Dust stays out;

lubricant stays in. Timken bearings roll the load for years, normally last the life of the machine.

Make sure you get all these moneysaving advantages, get the most from your machine. Specify Timken bearings because BETTER-ness rolls on Timken tapered roller bearings. The Timken Roller Bearing Company, Canton 6, Ohio, U.S.A. CANADIAN PLANT: St. Thomas, Ontario. Cable address: "TIMROSCO".



This symbol on a product means its bearings are the best.

TIMKEN Made CANADA

TAPERED ROLLER BEARINGS



